THE

CALCULTTA JOURNAL

OF

NATURAL HISTORY.

"Warum ich zuletzt am liebsten mit der Natur verkehre, ist, weil sie immer Recht hat und der Irrthum bloss auf meiner Seite seyn kann. Verhandle ich hingegen mit Menschen, so irren sie, dann ich, auch sie wieder, und immer so fort, da kommt nichts aufs Reine; weiss ich mich erst aber in die Natur zu schicken, so ist alles gethan."—G o e t h e.

"Why I after all prefer dealing with nature, is, because she is invariably in the right, and the wrong must needs be on my side. When I on the contrary deal with men, then they are in the wrong, then I myself, then they again, and so on continually, and it comes to nothing after all; have I however once found out the ways of nature, then all is right."

THE usual apology for being without a periodical in the metropolis of British India exclusively devoted to objects of science is, *that it would not pay.* This may be the reason, the only reason, why we have not long since had several philosophical publications in Calcutta, eclipsing those of Edinburgh, London, and other European Capitals. Without insinuating the existence of any more immediate cause for the above defect in our periodical literature, we must be permitted for the honor of the City of Palaces to doubt the accuracy of the one assigned, as nowhere are persons more liberal with their money on all public occasions, when interests of far less moment are at stake than those of science.

Without however having any serious design on the pockets of the public, we are disposed to put its taste to the test; and although the task could hardly have devolved on worse hands, we are determined to devote our pages solely to several departments of science, which at present only meet with a casual place in the Journals of this Presidency.

Although our Journal will be devoted exclusively to scientific objects, and particularly to the various branches of Natural History, it is hoped that if the multitudinous applications of these to useful purposes, mental as well as commercial, be taken into account, there are few whose tastes and interests will not be sufficiently concerned to give it their support.

The great object of the publication will be less to afford amusement than instruction; and above all, it will be our ambition to make known the Researches of Naturalists in subjects connected with Indian productions. With this view we shall bring together such facts as may be collected from time to time, and endeavour to keep before the public the exact state of the several subjects of inquiry, and the claims of those who are employed in them Having ourselves experienced the disadvantages of many who labour in the cause of science in the recesses of an Indian jungle, we shall therefore be the better able, both as naturalists and men, to appreciate results attained under disadvantages which can only be understood by those who have been exposed to them.

To answer all the above purposes to the full extent of our wishes, it would be necessary that the Botanical, Zoological, and Geological departments of our duties should

be conducted by separate individuals. It is to be regretted however that circumstances at present are not such as to allow us to carry this wish into effect.

It would be impossible to define exactly the different subjects which will legitimately come within the province of our Journal, so as to lay down any rules for the manner in which they are to be treated.

There are however some subjects, such as Topography, Geography, Meteorology, Statistics, &c. which though not strictly within the province of Natural History, are yet so intimately connected with it as to render it impossible to exclude them, and indeed when well executed they form works of the very highest interest, and will, together with journals and miscellaneous observations of naturalists, be always acceptable.

Geology is so connected with Natural History as to be almost identified with it, since a knowledge of living forms cannot be accurately appreciated without reference to those that have become extinct, nor these last, which we owe to the observations of geologists, without reference to existing species. Geological descriptions of districts will therefore form a much desired object of our Journal.

The philosophical subjects of comparative anatomy and physiology have hitherto been hardly entered upon in India, although the exuberance of both the animal and vegetable kingdoms afford facilities rarely presented in other parts of the world for researches of this nature.

On the subject of Natural History generally, it would be presumptuous in us to offer any suggestions to the class of contributors whose support we shall endeavour to merit,

particularly, as we are indebted ourselves to some of the friends in question for the advice we are about to offer, which is this,—That the subject should always be as fully treated as possible, whether it be the description of a species or of a group; its previous history, its rank, its characters, its distribution, and its uses should all be attended to where practicable. A subject so treated will always be more or less finished according to the capacity of the naturalist. It often happens however that in India the want of books prevents the naturalist from treating so fully of the historical part of his subject as could be wished, and of comparing the results to which he has been led with those of others. These are points however of comparatively less importance than such as depend on observation, as they may be supplied by those who have the advantage of libraries and leisure. Remarks on the characters, uses, distribution, and habits, can only be derived from observations on the spot, and if overlooked in the first instance may remain for years and even ages unknown.

Such is also the case with regard to the structure of animals and plants, such as are only met with stuffed or dried in collections, as well as that of testaceous animals; in all such cases observations, and when possible drawings, made on the spot will be invaluable.

While we would be thus minute regarding many points which persons ignorant of natural history would regard as trifling, let us not be careless of other important matters connected with useful properties which the naturalist is the most likely person to discover.

Thus the geologist should never lose an opportunity of

casting as much light as circumstances will admit of on the important question of coal and various other minerals. There are other objects to which the mind of the botanist and zoologist should in like manner be constantly alive. The causes of diseases, as the Goitre, Guinea-worm, Elephantiasis, and other complaints, which there are good reasons for supposing depend on circumstances which come within the province of the philosophic observer of nature, also hold out much encouragement to hope for important results, without interfering in any way with the more immediate object of his pursuits.

Having thus alluded to the objects to which we are to devote our pages, we may observe, that although these will be open to all communications calculated to improve our knowledge of any fact, it will be our duty to point out frankly, when necessary, our own opinions as to the manner in which the subject appears to us to be treated.

As two other scientific Journals have possession of the field, perhaps a word or two on the cause of our appearance may be necessary. With the "India Review" we are not likely to interfere, as the object of that work is chiefly the diffusion of popular science. The other, the "Journal of the Asiatic Society," is too closely identified with that institution to suffer from so puny a rival, were we even ambitious enough to dispute its claims to public favour; our field is altogether distinct, and although a new one, we doubt not that the labours of naturalists are sufficiently important to entitle them to a separate and independent organ. Indeed it has often been to us matter of surprise, that departments of science so important as those of Geology, Zoology, and Botany, should

have been so long without a Journal of their own in India. The consequence is, that neither the importance of those pursuits, nor that of the persons devoted to them, is at all understood; and naturalists at length find themselves without any individual connected with the periodical press, or with the learned Societies on this side of India, at all competent to meet their wishes or their views, far less to promote the object of their pursuits. Under these circumstances we have reluctantly deviated from the less obtrusive occupation we had prescribed to ourselves, and are prepared to use our best endeavours to secure for Natural History the advantage of a Journal hitherto much required in India.

The next subject on which we have to offer our remarks, is the means by which our publication is to be supported. As to matter we shall have no scarcity, as we trust we shall prove ourselves worthy of the confidence of most of the naturalists in India. The only difficulty we now experience, is to fix the rate at which we are to tax the pockets of our subscribers. We have no desire to profit by the work—our great object therefore is that its price should be as low as possible. On the whole, we consider that a subscription of sixteen rupees per annum will not only cover the expenses of the Journal but allow a certain sum to stand over for the publication of Transactions of an "Academy of Natural Science," as proposed in our first article, should that or any similar plan for the formation of a Society in India be eventually carried into effect.

With regard to the latter object, little more need be said than this—That if contributors of valuable articles will merely state whether they wish them to appear also in the *Actæ* of

our new institution, their wish shall be attended to as soon as our subscription list will bear the extra expense. In this way we might soon hope to get up the name of the proposed Society by the publication of a volume of Transactions, after which its course would be smooth and simple. At some future period indeed the geologists, zoologists, and botanists might find that the interests of their respective pursuits would be better attended to in separate institutions, and declare their independence of the first Society of Naturalists ever formed in India, just for the reasons we now quit the Asiatic and other Societies in Calcutta. Instead of regarding such movements or dissentions with jealousy or opposition, they are always to be hailed as favourable signs of the progress of knowledge, and of the advancement of Society to that elevated state of civilization, in which the human mind is brought to bear independently on distinct objects of research.

Prospectus of an Indian Association for the advancement of Natural Science.

THE additional interest that objects connected with natural history and geology has assumed within the last few years, renders it desirable, if not altogether necessary, to examine how far an institution solely devoted to such objects would be calculated to facilitate the cultivation of those sciences in India. It cannot have escaped those who are devoted to natural history that existing Societies are not adapted to promote that pursuit, as well from their paucity of means, as from their objects being chiefly directed to investigations in literature, agriculture, and medicine.

It appears also from the distance at which those naturalists are scattered over India who are competent to give a tone and character to the proceedings of a Society such as we allude to, that periodical meetings for the discussion of papers could not conveniently be held at any one place, and that in the absence of competent members, it were better that no such meetings were at all held.

With both these circumstances in view, it would be necessary in order to secure the efficiency and integrity of a Society of the kind proposed, to limit its business to such objects as should render meetings unnecessary.

The British Association as well as the Academia Naturæ Curiosorum, hold their meetings, the first in all parts of Great Britain and Ireland, and the second in all parts of Germany; and in as much as they are not confined to any particular town, assimilate to the character of the proposed Society for India. The only difference is, that here there could not conveniently be any meetings, as the cultivators of science are so few, and the nature of their various duties such as to prevent their assembling at any one place.

However agreeable it may be for men who are engaged in kindred pursuits to meet and discuss the several objects in which they are interested, yet this by no means constitutes an essential feature of the Societies in question, which must on the contrary depend entirely on the character of their transactions. With the exception therefore of the reading and discussion of papers, it would seem that we might possess Transactions, and by their means secure all the positive advantages which result from Societies such as those alluded to. The only officer that would be necessary on the spot would be a secretary, or agent, the latter term might be preferable, as implying a strict obedience to the wishes of those for whom he acts.

The elective body, or Committee, might consist of from eight to twelve names, such as would be a security for the character of the Society, and who would appoint annually three or four of their body as vice-presidents, to settle any doubtful points that might be referred to them by their agent.

It would not be advisable to have a larger number than from eight to twelve on the Committee at once, from the inconvenience that would be occasioned in deciding questions upon which it might become necessary to collect their opinions.

This last object could only be effected by means of circulars. The business of the Committee would be the election of vice-presidents once a year from among their number, as already stated, as well as to fill up vacancies in their own body; this, together with the occasional reference on matters of business would require, at some future time, the indulgence of the privilege of franking letters on the business of the Society to each of the members of the Committee, only however from one to another, which would enable them to keep up that intercourse with each other on matters of science which it is almost essential that

the savans of every nation should possess to a certain extent, but in India more particularly, from the impossibility of their holding any other kind of intercourse. This would be almost the only privilege which it would be necessary to solicit from the government, and as it would not amount to the general franking of letters, except from one member of the scientific Committee to another, we might hope that an application to the above effect would not be denied longer than the benefit to be derived from it should be clearly proved; which naturalists can only do at a small sacrifice to themselves in the first instance in the shape of postage.

The next step would be to effect an improvement in the character of communications, and from the examples which would be afforded by the Society, authors would naturally be more careful in their publications, and more zealous in their works; the effect of which would be a gradual advancement to more finished and carefully digested papers than have as yet become frequent in India, in which specific subjects are taken up at the beginning and carried through to the close, with all the information to be had in the country made to bear upon them. For this remark on what should constitute the object of writers, we are indebted to our friend Mr. H. Walker. Let us see now how a spirit and example of this kind would operate. In the first place, those who devote themselves privately to the study of the productions of the country would be brought into communication with each other, and both the government and individuals could refer to their counsel and advice in all matters falling within the province of naturalists to decide.

In the next place, the labours of many regarding the application of the sciences to useful purposes would be brought to bear from a focus, and the investigation of minerals, plants, and animals would be conducted with more energy and effect than if left to depend on the isolated exertions of individuals, or mixed up, as at present, with other pursuits with which naturalists have no sort of connection.

Let us take the state of our knowledge on any one subject that should come within the scope of natural history, and we shall find how much the interests of the country, both as regards its intellectual and social improvement, depends upon its investigation: as, for instance, our coal fields, our tea plants, and our fisheries. In all these matters we have every thing to accomplish, and although from their importance, private enterprise and the isolated observations of individuals may in time effect much, still in a country where the mind requires to be as yet formed for all such inquiries, both energy and example are requisite for conducting researches successfully to practical results.

There are no instances of men stumbling at once on great practical results in any thing, nor are there any instances of nations changing their character suddenly from intellectual darkness to wisdom; these things are not the results of chance, or of sudden efforts, however they may be supported by wealth; but of sedulous and well directed exertion of individuals and the force of their example on communities.

Seeing therefore how much depends on the exertion of naturalists and the progress of their pursuits in India, it is reasonable to expect that something should be done to concentrate and give energy to their labours; but this is less a subject for the consideration of others than for that of naturalists themselves.

It is one of the peculiarities of men engaged in the prosecution of original inquiry, that they are contented to go on in silence with their pursuits, heedless of every thing but the subject before them.

There are however occasions when it becomes necessary to look around, and see if with very little inconvenience we may not materially improve, not only our own facilities, but the facilities of those who are to follow in our pursuits; and it is a duty which we owe no less to the government than to ourselves, to secure for those pursuits to which we devote a large proportion of our time, such facilities as may be com-

patible with the circumstances in which we are placed, so as to render our labours useful to the country.

The plan now proposed for the constitution of a Society strictly directed to specific objects connected with natural science, differs but slightly, we are informed by our friend Mr. Walker, from that of one of the oldest and most successful Societies in Europe, the *Academia Naturæ Curiosorum,* which may have arisen out of somewhat similar circumstances in Germany, during the latter part of the sixteenth century, at a period when too few naturalists were found in any one city to carry on the duties of a Society. That *Academy* exists only in its *Actæ*, or transactions; it has no meetings or local habitation, and its business, which consists merely of the publication of memoirs, is conducted by a temporary secretary in any part of Germany where the individual on whom that honor is conferred may happen to reside.

In principle this is precisely what is proposed, so that it is so far fortunate to have an illustrious and successful example of what some might otherwise regard as visionary and impracticable.

One of the first objections that will be urged against the proposed institution is, that it will have a tendency to injure other Societies now existing in India; but the same objection might have been urged against every Society that has sprung up since the time the first was formed.

Our own little experience in India enables us to state, that the greatest danger to which Societies are here exposed, is the patronage of objects which are foreign to the peculiar qualifications of their leading members. Each of our three Societies of Calcutta afford instances, which have fallen within our own observation, of the great and serious error of this. So far therefore from a Society exclusively directed to the promotion of natural history proving injurious to any of the other institutions already existing, we feel assured that the change would prove a great relief to some of them, especially as we are prepared to show several instances in which they

have been called upon to make large sacrifices of funds for the purpose of promoting physical science, when the very effort was attended with opposite effects.

The next point which we have to consider, is the means of support for the proposed institution. As it is not proposed to have any monthly or other meetings, or to have any source of expenditure except that of the publication of transactions, those who subscribe can have little inducement beyond that of contributing to an object purely scientific.

If there be no transactions, there can be no expenditure, and if there be transactions, subscribers will have so much in return; but it is not merely to derive an equivalent in goods, nor even the pleasure of attending meetings, that induces persons to subscribe to Societies; they in general have far higher objects than the possession of influence, or the vanity of taking part in proceedings. It is reasonable therefore to suppose, that the list of subscribers to the Society would be sufficient to meet its expenses, beyond which there would be nothing more required in the beginning. A museum and a library might afterwards follow: the first object which from its nature would be inpracticable in any Society not ruled by naturalists, would in this be a natural consequence requiring no effort. In proof of this we may say, that our residence is a perfect store-house of fishes, birds, and insects poured in from all quarters, so that if we had the means of preserving objects, as well as of collecting and describing them, we could soon form a museum that would be worthy at once of the patronage of the government, and of the character of naturalists now resident in India.

The only security for the propriety of the requisite small subscription would rest with the Committee, which would assume the management of the Society; but as this Committee would consist of men on whom the character of the Society would depend, and who should have devoted their studies expressly to those objects which it is intended to promote, there should be no hesitation on the one hand to incur the

responsibility, nor want of confidence to confer it on the other. Could the difficulties attending this point be surmounted, it is evident that a Society would then be formed the sole management of which would be vested in the hands of men entirely devoted to its object.

The object of the proposed Society would be to collect a body of information regarding the natural history of the country, and to concentrate the labours of our naturalists, which have hitherto been interspersed throughout various publications, in a manner to render it difficult to refer to what really has been done.

The evil of scattered publication is in India the difficulty of obtaining books. If our naturalists for the want of any independent publication exclusively devoted to their own pursuits continue to send their communications to various Journals, and Societies here and in Europe, they must necessarily increase their own difficulties by the greater number of books which they will require to refer to. In consequence of this practice it already often happens, that to refer to a single paper on natural history it is necessary to purchase a volume of extraneous matter, and this evil must continue to increase until naturalists possess publications exclusively devoted to their own pursuits.

We have treated the subject of the proposed Society on distinct grounds, and altogether independent of a Journal, but we consider both to be indispensable to the advancement of natural history, and doubt not we shall live to see both flourish. The one as an independent advocate of truth, and the organ of those who are interested in the progress of natural history; the other, a repository in which the finished papers of naturalists in India may go forth to the world under the auspices of men practically acquainted either with their merits, or their defects.

The Silurian System. *By* R. I. Murchison, Esq. F.R.S., F.L.S.

Vice-President of the Geological Society of London, General Secretary British Association for the Advancement of Science, Member of the Royal Geographical Society, Honorary Member of the Royal Irish Academy, etc. etc. etc.

We propose in a series of articles to enter into an analysis of Mr. Murchison's great work on the Silurian System, for the perusal of which we are indebted to the liberality of our friend, and lover of science, Mr. J. W. Grant, C. S.; for its title alone would be enough to exclude it from all public libraries in this country. For the benefit of the uninitiated, we will first explain, that the author comprehends under the term *Silurian** those beds of ancient strata from the Old Red Sandstone down to the Crystalline, or primary rocks.

But the work is not confined to the investigations of these beds; before their difference from more recent deposits could be established, it was necessary to enter into an investigation of the latter as a preliminary object. The first views of Mr. Murchison on the subject before us were submitted to the first meeting of the British Association, since which time Mr. Murchison has been constantly engaged in following up the inquiry, and extending his observations, so that districts made subject to the investigation consist of the counties of Salop, Hereford, Radnor, Montgomery, Gloucester, Cærmarthen, Brecon, Pembroke, Monmouth, Worcester, and Stafford. And as the above counties contain some of our most important repositories of coal, much new information is afforded regarding them, which we shall endeavour to lay before our readers. But as this part of the work alone consists of nearly two hundred quarto pages, we shall be able to convey but a faint idea of its value.

* A geographical term derived from the *Silures,* whose power extended over the region where these rocks are best displayed, and the name of whose illustrious Chief, Caradoc (Caractacus) has been transmitted to us in a bold range of hills composed of one of the most important formations of the Silurian system.

Mr. Murchison begins the investigation by a description of the Oolitic beds which cross England from Dorsetshire to Yorkshire, forming the high districts of Oxfordshire and Gloucestershire, traces the limits of these beds, and points out the peculiar fossils by which the inferior part of the series is distinguished.

In a work devoted to philosophical objects, our readers will hardly be prepared to expect observations of so much practical importance as those which we are about to quote regarding the importance of geological science in guiding the operations of the practical miner, which we hope will have good effect in pointing out the error of being guided altogether by practical men in our investigations for coal. "In the vicinity of Burley-Dam some of the beds of Lias are so hard as to have induced Lord Combermere to quarry them for slating purposes, and others in the same vicinity being slightly bituminous have very much the aspect of Kimmeridge coal. The mineralogical characters of this formation so closely resemble coal shale, that those unacquainted with its stratigraphical position and zoological contents, particularly in Oxfordshire and other interior parts of the kingdom, have frequently sunk into it in search of coal." And a little further on, after enumerating the list of fossils in the lower Lias, Mr. Murchison observes, "it was gratifying to observe in this detached basin of North Salop shells identical with certain unpublished species first brought to notice by my visit to Brora, Sutherlandshire, the strata of which distant tract, containing a sort of coal, were by means of their organic remains identified with similar carbonaceous strata of the Oolitic System, in the eastern moorlands of Yorkshire. Had the Lias of this Salopian tract contained coal as good as that found in the Oolitic formations of Whitby and of Brora, it might have been questionable whether in a country so distant from any deposit of the old or true coal, it would have been worth extraction; but no trials have brought to light any por-

tion of combustible matter, whether termed lignite or impure coal, worthy of the name of a bed. To convince the resident gentry and speculators of northern Salop who are not aware of the value of the evidence afforded by organic remains, of the hopelessness of their search after coal, I beg to repeat, that the black shale is *underlaid* by the saliferous marls of the New Red Sandstone. In addition to the instances already given, I may state, that the sinkings of Sir Corbet Corbet at Adderley, opposite Kent's Rough, and near the northern edge of the basin, proved this fact; for upon piercing the black shale to the depth of 300 feet, a brine spring was reached! Lastly, an examination of the annexed wood cut* and the map will show, that the basin not only rests upon marls and other strata of the New Red System, but is surrounded by them; and a reference to the general tabular view attached to this work will prove that the whole of the enormously thick system of new red sandstone (as fully expanded here as in any part of England) lies between the black shale and the true coal measures. If coal really passes beneath any portion of this country, it ought to be first sought for at points nearer to Oswestry, Wrexham, Shrewsbury, Wellington, Newport, and Madeley in Staffordshire; in short, towards the out crop of the coal measures which rise nearly on all sides from beneath the new red sandstone. Now as this tract lies in the centre of the circle above mentioned, it is necessarily the very spot in the whole area where the search for coal is most hopeless, being that were the overlying deposits are thickest."

25.—On another occasion Mr. Murchison observes, that he had learnt that sinkings for coal had been carried on for some extent between Whitchurch and Market Drayton; but on examining the district, he soon found that the black shale supposed by the inhabitants to be coal-shale, was nothing more than Lias, as was proved by an abundance of fossils, and separated from the coal measures

* We regret we have not the means of introducing this cut.

by the new red sandstone. Again,—"On Walliston Common, Salop, in one of the attempts to find coal the Lias was bored, after sinking 250 feet, to a further depth of 150 feet, making a total of about 400 feet. A little black lignite or jet was found, but nothing to justify the most remote probability of the formation containing coal." At the mouth of the trial pits Mr. Murchison collected twenty-six species of fossil shells, six of which proving the formation to be identical with the Brora beds, in which a lignite occurs. In numerous other instances Mr. Murchison points out the ruinous consequences of sinking for coal without the advice and opinions of scientific men. Speaking of a spirited undertaking of the Earl of Dartmouth, in which seven hundred feet of sandstone was penetrated at Christ-Church, Mr. Murchison observes, that it is impossible to mention the success that attended the enterprise, without congratulating geologists on the effect which their writings are now producing on the minds of practical men, since it was entirely owing to inferences deduced from geological phenomena that this work was commenced, whilst its success was derided by many of the practical miners in the adjacent coal field. The south-east parts of the county of Durham have been rendered by this means a great and productive coal field, in spite of the prejudices and predictions of the old school of miners, to whom such important matters used to be entrusted. See p. 58—66.

The practical importance of the subject being established on such facts as these, we need not apologise to our readers for devoting a larger space to the notice of this work than its title and scientific details would seem to demand in an Indian Journal. The truth however is, that Mr. Murchison's work is the best model that could be chosen by the Indian geologists who would render efficient service either to science or to the practical value of the minerals of the country. To those who have not paid much attention to geology, we would remark, that the true coal formations repose between

two great formations of sandstones, named the New, and the Old Red—that the lower beds of the first, and the upper beds of the latter, may contain thin seams of poor coal, which, in order to appreciate properly when met with in an undescribed district, we should be able to refer to one or other of the two formations. If the thin seam of coal belong to the Old Red Sandstone, boring or sinking in search of a better bed would obviously be a waste of money, as we should rather direct our inquiries to overlying rocks, and if these do not occur, a further search for coal in the district would be useless. If, however, the coal seam belongs to the New Red Sandstone, our search should be extended to the older or underlying strata, not by boring, for then we might, like the gentlemen of Whitchurch and Market Drayton, have several thousand feet of new red sandstone between us and the coal, even if its existence were certain. It is only therefore where coal seams are met with in coal formations, that borings and sinkings should be resorted to.

Then the question arises, How are we to become acquainted with these important distinctions, on a knowledge of which the condition of society so much depends, especially in India? Fortunately for us, coal seems to be so abundant in India, that no great nicety is required to detect it; but to pursue the discovery, and to bring it into use, is another and more difficult task.

Mr. Murchison observes, that the Lias is succeeded in the descending series by beds of green and red marl, constituting the upper portion of the series of strata, called the New Red System, which includes all those beds of marl, sandstone, and limestone, which lie between the Lias and the carboniferous rocks, and which, from their development, are capable of being divided into formations by differences in lithological and fossiliferous characters. 1. Saliferous marls; 2. Red sandstone and quartzose conglomerate; 3. Conglomerate

and magnesian limestone; 4. Lower red sandstone. The first of these is described as occasionally presenting the appearance of a greenish kind of marlstone included in beds of red or green marls, of different degrees of tenacity; sometimes the colour is almost a grass green, and at others as white as chalk. It passes occasionally into a slightly micaceous calcareous grit. It would be exceedingly difficult, however, to give a mineralogical description of a formation which Mr. Murchison traces throughout a large tract of England, always appearing under some new character. The salt springs at Droitwich, and other places, have procured for it the name it bears. Salt springs occasionally occur in other formations perfectly distinct. Mr. Murchison considers the "Keuper" of foreign geologists is equivalent to the saliferous marls, and refers to a section made by Professor Sedgwick and himself, on the continent, to prove the identity of the rock in the two remote localities, England and Germany.

The "Keuper," however, abounds in fossil plants as well as animals; and Mr. Murchison has never been able to detect any trace of organic remains in the saliferous marls of England. "The fossils of the overlying and underlying formations in England being of marine origin, there is little doubt that the red marl must also have been deposited beneath the sea. In Germany and in France this inference is established by the presence of marine remains, in the "Keuper," "Muschelkalk," and "Bunter" sandstein,—the three principal formations of the system; the first of which, as before mentioned, represents our saliferous marls. The second, or great calcareous formation, has not yet been discovered in the British isles; and the third is the equivalent of the massive beds of central sandstones. The numerous brine springs, as well as masses of rock-salt, which are contained in the red marl, seems to offer additional proofs of the marine origin of

these deposits, since Dr. Daubeny has shewn that in many of these saline sources there is an admixture of iodine, a principle which is confined to the sea and its productions. This argument is not, however, to be considered decisive, but only as forming a portion of cumulative evidence, which taken in conjunction with that of the remains occurring in the deposits of this age on the continent, fortifies the conclusion, that our saliferous marls are of marine origin; for it might be said, that iodine and chloride of sodium have been derived in the first instance from the interior of the earth, and that the ocean may have owed its saltness to beds of rock-salt, as well as that rock-salt owes its origin to the evaporation of sea-water." Notwithstanding the difficulty of establishing the identity in remote quarters of the world, of rocks so vaguely characterised as the saliferous marls, yet when we have coal measures affording a certain fixed point, or land mark to guide us, we cannot be very far out in fixing upon the green marls, or often friable sandstone, which extend along the lower ridges of many parts of the great Himalayan chain, immediately adjoining the plains of Hindustan, as the Indian equivalent of the beds in question. Along the southern side of Assam we have the same rocks as well as brine springs, and an earthy limestone, probably equivalent to the English Lias. On the face of the Cherra mountain, the green marl rests unconformably on Old Red Sandstone, (or that on which the coal formation rests), and gives support to the deposits of sand in which the marine remains are contained. It is here by no means destitute of fossils as in other localities; on the contrary, we found in it six species of univalve shells, a small species of *Echinus* and a large spined *Cidaris*. In a note which we made on the characters of a fragment of rock brought away from a submerged reef near Arracan, by the hull of a ship which struck upon it, we pointed out the resemblance between its appearance and that of the green conglomerates in question.*

* Journ. Beng. As. Soc. 1838, p. 936.

A description of the salt formations at the head of the Indus, and their relative position to the coal measures recently found there by Mr. Jameson, will be the means of casting much important light on this subject in regard to India, and we have fortunately in the gentleman alluded to a geologist near the spot, fully alive to the importance of this and other questions of a similar nature. Another equally important question is the situation of the great repositories of salt in the vicinity of Ajmeer, and other situations in Central India, where salt lakes abound. Lieut. Fraser, of the Engineers, we recollect, sent us a fragment of rock-salt, which was found imbedded in a basaltic rock, when sinking a well at Mhow, about three feet from the surface. We have not heard that this curious fact has led to any further discovery or research in the neighbourhood alluded to.

The next beds of the New Red System described by Mr. Murchison, are the sandstone and quartzose conglomerates.* It is difficult to characterise these beds, otherwise than by the absence of saline impregnations, and occasional appearance of fragments of the older rocks, as in the last; fossils are said by Mr. Murchison to be rarely found in it in England, but in Ireland a profusion of small fish† were found in an equivalent rock at Rhone hill, near Dungannon. On the continent it is still more distinguished by numerous fossil plants, as *Equisetaceæ, Felices, Coniferæ Liliaceæ,* the whole of which are said to have a certain community of character peculiar to the age, and are very distinct from the plants of the overlying and underlying systems.

The third, and only other member of the New Red System hitherto detected in Great Britain, is the calcareous conglomerate, or lower new red sandstone, which in the central counties is equivalent to the magnesian limestone of the north-east, and the dolomitic conglomerate of the south-west of England. "They do not, however, contain solid beds of

* Called Bunter sandstein by the Germans, and Grés bigarrè by the French.

† *Pdlœniscus catopterus.*

magnesian limestone, and very seldom so much magnesia as to entitle them to the name of dolomitic conglomerate, but are for the most part simply calcareous conglomerates, consisting of fragments of quartzy, silurian, and other rocks, as well as of carboniferous and other limestones enveloped in a calcareous matrix. In the Tortworth district, at the northern extremity of the Bristol coal field, the true dolomitic conglomerate is considerably developed, and has been fully described by several geologists. In the north of Gloucestershire, and south of Worcester, where the new red sandstone is conterminous with the old red, there are no distinct traces of this member of the series, unless we suppose that the few thin courses of slightly calcarious conglomerates which occur at intervals near the bottom of the sandy series, be its representative."

"In the great expansion, however, of the new red system in the north of Worcestershire, in Staffordshire, and Shropshire, there are calcareous conglomerates of considerable thickness, which, as they pass beneath the great masses of red sandstone already described, there can be no hesitation in referring also to the age of the magnesian limestone. They occur in great force in the north-eastern face of the Lickey. See the Memoirs of Mr. Horner, Dr. Bright, Mr. Warburton, Messrs. Buckland and Conybeare, and Mr. Weaver; Geol. Trans. vol. III. and IV. old series, and vol. I. of new series. This dolomitic conglomerate is also described in this work in the chapter on Tortworth, and the position is marked near the south-eastern extremity of the accompanying map, and Clent hills, and appear also on the northern end of the Lickey ridge of quartz rock, whence they range by Kenelms to Hagley. In this course they distinctly overlie a great formation hereafter to be described as the lower new red sandstone, and rise high on the sides of the trap rocks of the Clent hills. They here vary much in importance, parti-

cularly near St. Kenelms and Hagley, some masses having a thickness of fifty and sixty feet, others not more than six or eight; at Garnow Green, near St. Kenelms, there are extensive lime works in this rock, an account of which may suffice for those at other localities."

"The beds dip very slightly to the south, and are separated from each other by sandy marls and clay. The greater part of this rock is made up of angular fragments of a pre-existing, very compact limestone, which, from the corals and other fossils found in it, proves to be the carboniferous limestone. In some parts of the quarries the rock consists of concretions of marl and fragments of sandstone and grits, with coal plants, imbedded in a pink calcareous grit; but in others, of small pebbles of quartz and still older rocks, enveloped in a red ferruginous, earthy basis, penetrated in all directions by white, crystallized carbonate of lime. The matrix and cement are throughout very calcareous, and the colour of the rock varies with that of the ingredients, from a reddish tinge, to shades of yellow and white. This conglomerate follows all the sinuosities and promontories of the Clent hills, as is well seen between the hills of Romsley and Walton, where associated with the red sandstone, it enters into a deep recess. It also folds round Hagley park, (near the parsonage,) accommodating its outline to the form of the hills, where it has been described by the Rev. J. Yates, as a calcareous breccia, consisting of grains of quartz, decomposing felspar, and limestone. Transverse sections, from north to south, across the strata, are exhibited on the sides of the roads, which ascend to the Clent hills by St. Kenelms, or by Hunnington, and expose several lower calcareous courses, separated by argillaceous red marls and sandstone. Calcareous bands prevail so much in this district, re-occurring at intervals in the scarpments, through a thickness of many hundred feet, that if they were all included in this division,

it would be impracticable to define with precision their limits, since they graduate into, and form a part of the lower red sandstone, which in its turn overlies and passes into the coal measures. It will indeed be shown in the sequel, that other calcareous beds, for the most part, however, of true *concretionary* structure, are even traceable down into the coal measures; and for this reason, I restrict the comparison with the magnesian limestone, or *dolomitic conglomerate*, to the mass of this rock which immediately lies beneath the central sandstones," (Bunter sandstein, or Grès bigarrè.)

"Calcareous conglomerates are to be seen at many points round the outline of the Dudley and Wolverhampton coal-fields, generally at some little distance from the edge of the coal-bearing strata, and always dipping away from, or overlying them."

It is impossible in a work composed almost entirely of important details, on which the principles of geological science so much depend, to offer any abstract or comments half so instructive as simple quotations from the observations of the author, especially as sandstones and rocks of the coal formation prevail very extensively in nearly all parts of India. It is extremely important, that the relative position of the sandstones and coal-bearing strata of India should be clearly described, and that all the points in which they differ from, or agree with, similar rocks in other parts of the world, should be investigated. In a private letter from our friend Mr. Jameson, we learn that he has observed extensive tracts composed of silurian rocks, and sandstone of the Old Red System, in the north-western parts of India. Under these circumstances, we feel assured that we can render no better service than by quoting largely from the pages of a work, which otherwise would, from its price, be little known in India.

The calcareous strata of the New Red System at Coton, where they are burned for lime, are described as coarse conglomerate, composed chiefly of fragments of carboniferous

limestone, generally rounded and red on their exterior. Some of them are of an oolitic structure; others a compact limestone, containing encrimites, corals, and terebratulæ, and discoloured, partly by films of green carbonate of copper; secondly, conglomerate with fewer fragments of limestone but containing pebbles of quartz, old red sandstone, &c.; the whole cemented by pure white crystallized carbonate of lime. This conglomerate passes into a pink calcareous sandstone, with pebbles and minute fragments of jasper.

"In attempting to refer the fragments of limestone to the original rock, the oolitic structure distinctly proves that some of them have not been derived from any formation below the Old Red Sandstone, while the nearest known masses of a similar rock are in the carboniferous limestone of the Clee hills, twenty miles distant. The included fossils belong likewise to the same deposit, while the rolled condition of the fragments, accords with the idea of their having been drifted from the quarter alluded to. At Coal-Brook Dale coal-fields the conglomerate is not sufficiently calcareous to be burnt for lime, being chiefly composed of rounded fragments of sandstone and quartz, with some fragments of carboniferous limestone, in a base of quartzose and calcareous sand. Here, as in other localities before mentioned, the strata dip away from the adjacent coal-field, from which, as we shall afterwards perceive, they are separated by a great fault. The extensive denudation of the whole series of the New Red System between Newport and Shrewsbury, has obliterated all traces of the calcareous conglomerates, which are not met with again till we approach Shrewsbury where a small face of the rock can be seen, which was formerly quarried to burn for lime, but is rapidly lost, dipping to about 30° under the sandstone. To the north and west of this spot, the relations to the various members of the New Red System, which overlie the coal bearing strata of Poutes-

bury, are much obscured by a thick cover of coarse gravel and clay. In other situations north of the Severn, the calcareous conglomerate of the New Red System contains angular fragments of cream-coloured limestone, in a reddish sandy calcareous matrix, in which small cavities occasionally occur lined with crystals of dolomite. Limestone containing magnesia is abundant in some beds of mountain, or carboniferous limestone in the same vicinity, and that rock being of older date, may have supplied many of the enclosed materials, and much of the cement of this conglomerate."

Some fragments of limestone of large size, derived from the breaking up of a peculiar fresh water limestone intercalated between seams of coal, are also contained in it, as well as small round quartzose and other pebbles of more ancient rocks. Although Mr. Murchison observes it has been stated in the previous pages that no remains of shells have yet been detected in the overlying members of the New Red System in England, a considerable number of curious unpublished species have recently been discovered at Manchester in beds of the variegated marl. These shelly marls are considered by Professor Sedgwick to lie beneath the upper and central members of the New Red System, and Professor Phillips, who has recently worked out in some detail the relations of strata in the environs of Manchester, is of the same opinion. In a letter to Mr. Murchison, he describes these shelly marls as lying between the sandstone and quartzose conglomerates, *grès bigarrè*, and the lower beds of the New Red System, and observes, "I view them as attenuated and deteriorated magnesian limestone, the last term of the degradation of this rock;" it is therefore inferred that the Manchester shelly beds are of the same age as the calcareous and dolomitic conglomerates of Salop, Worcester, and Stafford, which are the equivalents of the magnesian limestone.

These marls are said by Mr. Murchison to be of great

interest as links connecting the lower new red sandstones with strata of the same age in the north of England, which are known to geologists through the labours of Professor Sedgwick. Among the shells from the marls at Colyhurst Professor Phillips recognises *Axinus obscurus*, or a large variety of that species, as the most prevalent, associated with an *avicula*, not very remote from *A. sociales*, and many small undescribed univalves.

"Having now described the three upper divisions of the series in those districts where their characters and order of super-position are distinct, I might at once proceed to the examination of the subjacent sandstones where they are most expanded, as around the coal fields of the central counties. It is desirable however previously to invite attention to the prevailing characters of the lower portion of the system in Gloucestershire and the west of Worcestershire, where being little more developed the whole of its lower portion consisting of conglomerates and sandstone is so intimately connected that they can be considered only under one head."

The members composing the bottom of the system are occasionally difficult to identify in different localities, as their characters are mixed, sometimes calcareous, at others quartzose, and occasionally containing a great abundance of pebbles and fragments of trap rock, intermixed with sedimentary rocks of great antiquity.

Having traced the line of demarcation between the New Red Sandstone and the older rocks on which they rest, "I commence by pointing out the manner in which from small beginnings in the south their successive development is accomplished as we proceed northward. At Huntley soft red sandstones first appear rising from beneath the marls, and separating them from silurian rocks; and between that place and Newent, where the sandstone attains a considerable thickness, there are traces of quartzose conglomerates

occasionally cemented by calcareous matter. These relations prevail for some miles to the north of Newent, the lower beds of the system overlying a thin zone of coal measure; but in approaching the Malvern hills, the sandstones are much more exposed, and the conglomerate near their base is of greater importance, and of different lithological composition. In the absence of natural sections, the presence of the sandstone above the conglomerate (Grès bigarrè), is clearly indicated by the "Rye Sand," or sandy loams, which uniformly give a dry agricultural character to the surface of all the tracts occupied by that member of the system. Between Huntley and Lynes Place are good sections of the sandstone arranged in fine-grained, friable, thickish beds, beds of deep red colours, and containing subordinate irregular courses of a small conglomerate, in which are fragments of the old red sandstone, and inferior rocks. Some of these conglomerates are slightly calcareous, others pass into mere grits, the whole resting upon and thinning out in light-coloured incoherent sand, and the line of separation is sometimes defined by the nature of the surface, at others by sections exhibiting thin patches of coal measures interpolated between the New and Old Red Sandstones." Clear junctions of the New and Old Red Systems are seen at Hoffield Camp, the first appearing as soft red sandstone, and the second, of brecciated conglomerate, of a deep red colour, containing fragments of syenite, varieties of silurian rocks, quartz rock, and old red sandstone.

"Almost adjoining the sandstone of Black's Well, and constituting the southern side of the gorge at Knightsford Bridge, through which the Teme escapes from Herefordshire into the plains of Worcestershire, is a remarkable cliff called "Rosemary Rock," the summit of which is about three hundred and fifty feet above the sea; at this spot the Old Red and New Red Sandstone are again conterminous,

being separated by only an alluvial meadow. The northern face of Rosemary Rock is the finest vertical section of the coarse conglomerate near the base of the New Red, with which I am acquainted. The fragments vary from a large size to that of almonds, and are both rounded and angular; the greater number and largest, consisting of a purple coloured concretionary trap, hereafter to be described, which occurs in the hills of Barrow, Woodbury, and Abberley, the northern prolongation of the Malvern ridge. The other fragments are chiefly referrible to the Silurian System, and among them are quartz rock, indurated schist, and other altered rocks. The cement is partly calcareous, with a few veins of white calcareous spar. On a hasty inspection, this rock and others resembling it along this chain of hills, might be mistaken for the trap rocks, from which they have been partly derived, but the admixture of fragments of stratified rocks of the Silurian and Old Red Systems, distinctly proves its regenerated character. The summits of those hills lying to the north of the Teme, which are marked in the map as trap, exhibit on the contrary, no fragments except those of a peculiar rock, predomenant in this range and in the Clent hills."

At Collins' Green, conglomerates like those of Rosemary rock, associated with beds of deep red sandstone, rise to the same height as the ridge of silurian rocks, from the flanks of which they dip 20° to 25° south-east. In this conglomerate are also many portions of silicefied schist, quartz rock, and altered silurian rock. The silurian and trap rocks subsiding to the west of Martley, the New Red Sandstone is again conterminous with the Old; and with the depression of the older and intrusive rocks we find a corresponding absence of coarse conglomerate and trappean fragments; the deep coloured thick bedded sandstone of Martley, being nearly free from all pebbles and foreign fragments. In the north-

western parts of Worcestershire the New Red System begins to expand; and conglomerates, such as those described, are partially underlaid by soft red sandstone, both on the eastern flanks of Walsgrave hill, near the Hundred House, and at the termination of the Abberley Ridge. Thence to the north, the boundary line of the New Red Sandstone comes in contact with the stiff clays and flagstones of the Old Red, but within two miles of Bewdley it begins to flank the coal measures; and other examples of the angular, coarse, and trappean conglomerate, or breccia, occur, the fragments of trap having been derived, it is presumed, from Stugbury hill. A similar rock is found at Wars Hill, on the left bank of the Severn, also rising up on the edge of the lower New Red, where it is bounded by the Old Red Sandstone, the conglomerate being interposed between the intrusive rock and the soft sandstone of Kidderminster! The same conglomerate, subordinate to, and winding through masses of thick bedded sandstone, are instructively displayed at Winterdine, near Bewdley, and contain fragments of coal measure, grits, and concretionary trap, both of which rocks being in site adjacent to the conglomerate, are of angular forms, whilst the quartz and pebbles of older rocks, which have been transported from greater distance, are rounded. These strata are unconformable to the adjoining sandstone and grits of the coal measures, and pass beneath the Red Sandstone which forms the cliffs on the left bank of the Severn, and ranges to the town of Kidderminster.

"We may therefore proceed to the consideration of the structure of these tracts where natural sections exposing a full development of the lower members of the system, exhibit, besides the calcareous and other conglomerates before described, the Lower New Red Sandstone as a great and distinct subjacent formation of sandstone, marl, and shale, with subordinate courses of impure concretionary limestone, the whole passing down gradually into the carboniferous system."

4. Lower New Red Sandstone.—Foreign Synonyms: *Rothe-tode liegende* (Ger.) *Gres des Vosges couches inferieures.* (Fr.)

"When fully developed, as in the tracts of Worcestershire, Staffordshire, and Shropshire, where I shall now describe it, this formation differs essentially in lithological structure from any rocks we have previously considered. As a mass it may be said to consist of sandstones and grits, chiefly of a red colour, sometimes argillaceous, very frequently calcareous, associated with deep brown red shales and marls, occasionally spotted green. Grains of whitish, decomposed felspar are frequent in a matrix of dull red sandstone, iron in various states is here and there disseminated, and bands of impure concretionary and mottled limestone re-occur at various levels. Towards the base, many fragments of impressions of plants appear in beds of sandstone, which graduate into other and lower strata, containing thin seams of coal, from which there is a conformable descending passage into the true carboniferous system. In general these rocks contain much argillaceous matter, which on decomposing gives a striking resemblance in the surface of the country to those tracts which are occupied by the Old Red Sandstone; whilst some of the calcareous bands above mentioned are associated with hard flagstones. So completely, indeed, do these bands resemble the cornstone of the Old Red Sandstone, that they were formerly described from a part of this very tract as belonging to that formation. There is now, however, no doubt respecting their age, since besides their clear superposition to the coal measures, some of these beds contain fragments of mountain limestone, and sandstone with coal plants. This is one of the many proofs (ample testimony of which will be found throughout this volume,) of the danger of testing the age of rocks by any peculiarity in their mineral character, however striking: for the graphic description of the cornstone of the Old Red Sandstone,

given by Dr. Buckland, is derived from specimens now proved to belong to the *New* Red System. I cannot, however, make this observation without remarking, that the mere lithological character of many of these beds might still mislead the most practised geologist, if he had not worked out the relations of all the other rocks of the district.* Upon the eastern face of the Clent Hills, the Lower New Red appears as a highly argillaceous Red Sandstone, underlying the chief bands of calcareous conglomerate of Frankley and Gannow Green, and dipping away from small patches of coal, on the north-eastern face of the quartz rock of the Lickey Hills, and at the southern end of the great Dudley coal-field. There is distinct proof in both tracts, that the Lower Red Sandstone is conformable to, and passes into underlying coal measures; but as the latter are of very poor quality, and are in fact mere layers of carbonaceous matter, they have in most instances not been wrought; whilst in others where they have, the works being abandoned, the relations are but little known. It is certain, however, that to the east of Rubury Hill the strata dip to the east at a slight angle, and pass with apparent conformability beneath the Red Sandstone. Between Hales-Owen and Hagley, at Wassall Grove and Lutley, poor coal seams are apparent in natural sections, forming the lowest portion of this system, or top of the carboniferous strata, and dipping beneath the conglomerate and Red Sandstone of the St. Kenelms and Clent Hills. Among the most instructive excavations opened in these rocks, are

* "In my own case, for example, I am bound to acknowledge, that misled by mineral characters in the first year of my survey, I laid down an adjacent tract of the Lower New Red as Old Red Sandstone; an error which I only rectified by working out the relations of all the surrounding rocks. Mr. Greenough in the table of superposition illustrative of his map, has noticed the occurrence of cornstones, both in the New and Old Red Sandstone. It may be stated, that the inhabitants make no distinction between the half-concretionary, half-conglomerate, calcareous masses in the New, and those in the Old Red Sandstone. In the country, however, of the Old Red Sandstone, the name of "cornstone" is restricted to the coarse, sandy, conglomerate-like masses, and is never applied to the large concretions of purer limestone"

those of the Quarry Hill, south of Hales-Owen, where thick bedded, red, gritty sandstones, both soft and hard, are extracted for troughs, slabs, and building purposes, and contain irregular thin seams, filled with minute fragments of coal; whilst lower beds rising from beneath, pass into layers of hard grey grit, in parts calcareous, their surfaces being covered with fragments of coal and impressions of stems of plants. From these beds there is a gradual passage into the coal tract of the neighbourhood of Hales-Owen. At Coleman's Hill and Hodge Hill, in the same district, there are other sections, the strata in which, though differing somewhat in mineral characters, belong to this lower division of the New Red System; and these also exhibit passages into the coal measures. At Coleman's Hill, the upper beds consist of yellowish, soft, gritty sandstone, containing some small, calcareous fragments, a few pebbles of quartz, blotches of red shale, and fragments of sandstone with impressions of stems of plants! This sandstone graduates into thick bedded calcareous grit, spotted with bluish grey, black, and yellow colours, and partially burnt for lime. The spotted appearance is due to fragments of coaly matter, mixed with imperfect concretions of crystallized carbonate of lime, and blotches of ochreous decomposing sandy matter. The sandstones of this age occupy a distinct ridge from Hodge Hill by the Two Gates, to near Hales-Owen. They are for the most part of a yellow colour, are very cellular, and are not unlike portions of this part of the system in the county of Durham, which Professor Sedgwick has identified with the Rothe-todte-liegende. I allude particularly to the soft, white, yellow, and red sandstones on the banks of the Wear, at Clack's Heugh, &c., near Sunderland. On the sides of the gullies poor and thin seams of coal are exposed; and one of them occurring in grey calcareous breccia, similar to that of Coleman's Hill, is made up of fragments of coal, sandstone, schist, and limestone, in a calcareous cement. In the bed of a brook under Wassall Grove, I observed a seam of this coal

three or four inches thick, overlaid by what may be termed a *carboniferous cornstone*, somewhat resembling that of Coleman's Hill, and containing small interspersed fragments of bitumenized vegetable matter, rounded, and apparently water-worn, like the pieces of drifted wood seen upon the sea-coast. The calcareous bed passes upwards into thin bedded, brownish yellow sandstone, weathering to a reddish colour, in the fine natural sections seen as we descend."

"I. Mr. W. Hamilton, then Secretary to the Geological Society, accompanied me in one of my visits to the district around Hales-Owen, and he can bear witness to the quantity of impressions of stems, &c. of plants which we observed in the strata of the Lower New Red Sandstone. Specimens of these may be obtained in the Quarry Hill and Coleman's Hill. From these hills of yellow sandstones, to the edge of the great Dudley coal-field, whether from the Windmills and Two Gates, or from Hodge Hill, we find the following succession—

1st. Beds of incoherent soft yellow sandstone, with calcareous courses, and thin seams and fragments of coal.

2nd. Argillaceous strata, generally red, and of considerable thickness.

3rd. Sandstone, alternating with a peculiar trap-cuf. This rock sometimes assumes spheroidal forms, and will be further described in the chapter on Dudley. It contains quartz, pebbles, and fragments of coal plants, is often highly ferruginous, and passes down into strata containing small concretions of ironstone.

4th. Calcareous shale with seams of coal, which have been, and are still worked."

"It appears, therefore, that between Hagley and Hales-Owen, there are all the proofs of a Lower New Red Sandstone distinctly underlying the masses described in the previous pages, and passing down into carboniferous strata so gradually, that it is difficult to draw the line of separation, or define it with any accuracy upon a map. As this Lower New Red approaches the Clent Hills, it is inclined to the south, and is

there surmounted by the calcareous conglomerate or central and upper strata of the New Red System. At whatever point we fix the limit between the overlying sandstones and the coal measures, it must be borne in mind, that the only carboniferous strata into which these beds graduate in this immediate neighbourhood, constitute the poor and slightly productive end of the Dudley field, and that speculations in search of coal seams, by sinking to great depths beneath the Lower New Red in this tract would be quite ruinous, since we know that the mineral thins out to mere shreds in its course to the south: further explanations of this point will be given in the account of the Dudley coal-field. In following the margin of the great Staffordshire coal-field, we invariably find that wherever gravel and superficial detritus does not obscure the relations of the strata, a zone of red sandstones, of considerable thickness, is interposed between the coal and the calcareous conglomerate. At the Stand Hills it is a hard, greyish, partially reddish, and slightly calcareous sandstone, with a few blotches of yellowish marl, and some veins of white carbonate of lime, passing upwards into a pebbly, deep red, soft sandstone. At the straits between Himley and Turner's Hill, it is a thick-bedded, deep red, soft sandstone, in parts slightly calcareous, full of irregular joints and those numerous transverse striæ or lines of false bedding so common in the New Red Sandstone, with occasional lumps of harder calcareous grit. At Sedgely, it is a hard, red, slightly calcareous sandstone, with spots of green passing upwards into red argillaceous marl. These localities are all on the west side of the fields, and the strata invariably dip to the west, or from the underlying coal measures! On the eastern side of the coal field these sandstones are much more obscured by coarse gravel, but in several situations they are seen to be overlaid by a red calcareous conglomerate, which also dips away from the coal-field, or to the east. The great thickness of these lower sandstones has been recently proved by the

spirited undertaking of the Earl of Dartmouth," already alluded to, to sink through them for coal. "These workings descended through a variety of red and spotted sandstones, blotches deep red, and variegated marls, and thick courses of red calcareous grit, concretions of impure limestone (cornstone) and ferruginous deep red, hard, calcareous sandstone; the fissures in the rock being sometimes coated with crystals of coloured pink sulphate of barytes and sulphate of iron. At my last visit the shafts, then at a depth of two hundred yards, were passing through a light red micaceous sandstone, in which blotches of ferruginous marl were mixed with grains of carbonaceous matter. Some of the layers of this rock were separated by laminæ of black mica; concretions of calcareous sandstones as round as cannon balls, occurred at intervals, and altogether there was so much calcareous matter as to give the rock a very concretionary aspect. The reader will perceive that these are the very same strata which overlie the coal in natural sections at other places, and hence there could be little difficulty in predicting that coal measures would be found beneath them, particularly as it is well known that the coal seams of the adjacent field of Dudley do not deteriorate or thin out in the vicinity of these works, but are simply faults.

"The existence of the upper beds of coal having been ascertained by borings carried down to a depth of more than seven hundred feet below the surface, they (and the lower beds) have since been reached by sinkings, an account of which with a full description of the strata passed through, will be given in the chapter on the Dudley coal-field. In the eastern parts of Shropshire, between Enville and Bridgenorth, the Lower Red Sandstone occupies low terraces and depressions beneath the calcareous conglomerate, and at Shatterford is conterminous with a thin band of coal measures. The uppermost strata are so very similar to those of the great mass of rock above the calcareous conglomerate, that the description of the one may almost serve for that of the other. Thus, for example, in the cliffs opposite Bridgenorth,

and in the mass of rock on which the town itself is built, the beds possess nearly all the characters of the sandstones in the higher parts of the system, being thick-bedded, soft, of a deep red colour, and traversed by innumerable lines of false bedding, which often meet in wedge-like forms.

"I may here remark, that whether considered in its central or in its lower member there is no system of rocks which occasionally offers greater difficulties for determining its real laminæ of deposit than the New Red Sandstone. Besides the joints or fissures, the diagonal lines of false stratification are sometimes so prevalent, that it is only by tracing at wider intervals the true laminæ of deposit, as marked by herbage or moss, that we can correctly ascertain the real dip of the strata. As these appearances sometimes re-occur from top to bottom of cliffs two and three hundred feet in height, and as the intervals between the true beds is often fifteen or twenty feet, it at first sight does not seem easy to assign an adequate cause for the accumulation of such a vast number of interjacent laminæ, parallel to each other in separate wedges, yet divergent from the lines of true bedding. Such appearances are to be found to a certain extent in rocks of all ages, and however difficult it may be to explain the precise method by which water can have deposited the grains of sand in these positions, we have positive evidence of precisely similar phenomena, not only in young tertiary deposits like the crag, but also in those accumulations of the modern era, which having been formed under the sea, have subsequently been raised up, and occupy low cliffs along certain parts of the coast of our island."*

* "See description of a raised beach on the north coast of Devonshire, by the Rev. Professor Sedgwick, and Mr. Murchison, Geol. Proceed. xi. No. 48. Mr. Lyell has given an ingenious explanation of the manner in which these transverse laminæ may have been formed by water, in showing how similar inclined planes of sand are accumulated by wind. Mr. De la Beche also throws light on the origin of this false bedding, Theoret. Res. in Geol p. 88." It appears to us unnecessary to limit the cause of the phenomena alluded to, to the action of water alone; why might winds not also have been engaged in producing them as they are at present? The traveller on the Ganges and Bramaputra has frequent opportunities of observing the peculiar structure alluded to in sands of many miles in breadth on either side of the streams.—Ed.

To the south and north of Bridgenorth the lower beds of New Red, as exposed on both banks of the Severn, are similar in all respects to those described elsewhere, consisting of brownish, red, argillaceous and calcareous sandstone, flaglike calcareous grits, with occasional underlying, slightly red and yellowish sandstones, not unlike certain coal grits. Before, however, we take leave of this tract, a little more detail is called for, respecting the relations of the Lower New Red to the south of Bridgenorth, where the formation has been generally confounded with the Old Red Sandstone; though it is clearly separated on many points from that system by a zone of coal measures. Such is distinctly seen at Chelmarsh, where a ridge consisting entirely of the Lower Red Sandstone and associated beds of calcareous concretions, overlies in conformable opposition, and graduates downwards into strata, containing seams of coal. The descending order on the western slope of Chelmarsh Common is as follows:-

1. Red Sandstones passing into calcareous conglomerates, sometimes of concretionary structures.

2. Argillaceous marls and clay, with beds of whitish sandstone, occasionally with green grains.

3. First traces of coal measures, viz. dark and grey shale and light coloured sandstone, with seams of coal, too poor to be worked.

4. Top coal of this district twenty-two inches thick, the highest bed in use.

5. Calcareous concretions of grey and green colours, resembling certain varieties of the cornstone of the Old and New Systems; a band of this limestone is seen in the bed of the Borle Brook, dipping under the top coal.

6. Lower coal, two feet six inches thick, with associated measures, lies at some depth beneath the limestone, but is not now in work.

All these beds, from the lower coal to the overlying red

and green sandstone with calcareous conglomerate, dip to the south-east, about four inches in a yard.

This is indisputably one of the clearest natural sections in the range of the Lower New Red Sandstone, exposing a passage downwards to the coal measures. As these argillaceous concretions are thus proved to belong to the Lower New Red Sandstone, we thereby determine the age of other sandstones, which distinctly overlying them, occur on both banks of the Severn, at Hagley, Stanley, and Alveley, and which most geologists, (myself included during my early examinations of this tract,) erroneously considered to belong to the Old Red Sandstone. Seeing the inter-stratification of so many beds of stiff red clay with calcareous concretions perfectly resembling the true cornstone of the Old Red, and also beds in which the surfaces are occasionally covered with large plates of mica, it was difficult to believe that these rocks did not really belong to that system. By attention, however, to the relations of these sandstones to the surrounding strata, it becomes clear that they belong to the New Red System; for besides the proofs of their superposition in this tract, they may be traced pursuing the same course, and uniting with the sandstones of Hagley, the Clent Hills, Hales-Owen; and the strata which surround and overlie the coal-fields of Coal-Brook Dale and Shrewsbury.

The Red Sandstone of Alveley, Hagley, and Stanley, which contains calcareous concretions or cornstones, (several masses of which are burnt for lime, is a thick-bedded sandstone, without mica, the lamination frequently marked by purple stripes, with here and there half-formed, small concretions of green and red marl. The coarser, or gritty beds are very largely quarried for grindstones, which are used at Birmingham in the manufacture of gun barrels. The grindstones are not unusually three and a half feet thick, by ten

or twelve in diameter.* These grits are frequently calcareous, and are composed chiefly of grains of deep red quartzose sand, with white specks of decomposed felspar. Although, therefore, they do not much resemble the ordinary strata of the New Red Sandstone, they are unlike any beds in the Old Red System. And though it may be difficult, nay, in some cases impracticable, to distinguish the calcareous concretions of the one system, from the cornstones and limestones of the other, we have a safe guide in the order of superposition; and the absence of the fishes, and organic remains of the Old Red Sandstone, is negative evidence of some use in assisting the inquirer.

"In subsequent remarks upon the carboniferous deposits of these tracts, it will be explained how the coal measures which appear in patches in the bed and banks of the Severn, have been brought to light from beneath this cover of the Lower New Red Sandstone. This member of the system is developed on both banks of the Severn, north of Bridgenorth, or between that town and Madeley, leaving no doubt of its age since it is seen overlying, and dipping away from a thin zone of coal at Tasley and Coughley; and where some of the harder courses also contain calcareous sandstones.

A most instructive transverse section can also be made by passing from the high terrace of Apley to the lower ridges, in which are situated the park and house of Mr. Whitmore. The change observed in passing from the fine sandy and loamy soil of the upper and middle portion, to the cold argillaceous surface of the lower division of the system, is quite as marked, as the contrast between the agricultural surface of the New and Old Red Sandstones, where those systems are brought together in Gloucestershire and parts of Worcestershire. So complete is the resemblance between this lower member of the New Red and the Old Red Sandstone itself, that I confess it was only the clear order of superposition which convinced me, that this zone of sandstone and clay really formed part of the younger system. Near Apley Park Lodge, quarries

* "The stone was also formerly much extracted for the furnace hearths of blast-houses, but experience has taught the iron-masters, that many other sandstones are equally serviceable for that purpose. The coarser beds contain small fragments and concretions of marl. They are also used as building stones."

have been opened in this rock to the depth of thirty feet, exposing a hard greenish and deep red sandstone, in parts calcareous, in others slightly concretionary and conglomerated, the whole subordinate to stiff red, argillaceous marl or shale. Here, as at Cantern Bank, near Tasley, the beds lie conformably upon the coal strata, a band of which appears below in the bed of the Severn, while the superior face of the red rock dips beneath the overlying conglomerate of Apley Terrace. As Mr. J. Prestwich, to whose labours in this coal-field I shall have occasion to allude hereafter, has discovered plants in these Lower Red Sandstones, the analogy to strata of similar age near Hales-Owen, Hagley, Shrewsbury, and other places is complete.

" On following this rock to Coal-Port Bank, we there see it exhibited in deep vertical sections. Thick and thin bedded, red, argillaceous sandstones, yellowish and greenish grits, occasionally calcareous, with way-boards of argillaceous marl, constitute the upper cliff, dipping to the east 10° under an argillaceous cover, and resting upon thick bedded red sandstone, having a slight tendency to conglomerate structure. The other varieties of this rock contain rounded grains of quartz, and white specks, probably of decomposed felspar, with little iron pyrites in a calcareous paste, together with bands of coarse-grained, pebbly grit, and specks of chlorite, in a cement of white crystallized carbonate of lime. Some of the calcareous grits enclose concretions of green and red marl, thus resembling the impure cornstones of the Old Red Sandstone. Between Coal-Port and Madeley this sandstone is affected by powerful faults, to the chief of which I shall advert in a subsequent chapter; it being enough for my present purpose to state, that along the boundary of this field, as in Staffordshire, great dislocations equally affect the carboniferous strata and the Lower New Red Sandstone!* A transverse section from Sturchley to Shifnal, across Nedge Hill, like those previously cited, exposes sandstones and flaggy grits, both green and red, and thin courses of slightly calcareous conglomerates and flagstones, associated with much argillaceous marl; the whole passing beneath the younger group of Shifnal, &c. The country around Shifnal, Sheriff-Hales, and Crackley Bank, is covered with the quartz pebbles of the disintegrated conglomerate, beneath which a dark coloured, finely laminated, soft sandstone is seen at intervals; but these beds, as well as

* These are all elaborately described by Mr. J. Prestwich, in whose Memoir, preparing for publication in the Geological Transactions, will be found valuable details of the dislocations of the carboniferous and associated strata in this vicinity

all those situated midway between Bridgenorth and Wolverhampton, and occupying points intermediate between the coal-fields of Staffordshire and Coal-Brook Dale, belong rather to the overlying or great central mass of sandstone. At Lilleshall, the same instructive section as that from Nedge Hill to Shifnal is repeated, with still greater clearness and fuller development. In the slopes of the hills below the terrace on which Lilleshall House is built, are stiff, argillaceous beds, which produce a cold and unmanagable soil. Other sandy beds, on the contrary, are quite incoherent and very largely micaceous, a rare feature in the supracarbonaceous strata. At Lilleshall Abbey, the lowest strata apparent on the surface are thick-bedded, light brownish sandstones.

"The junction of these with the underlying coal has never yet been ascertained, but there can exist no doubt of these being the true beds of passage into the carboniferous system. Portions of this sandstone are seen at one or two points along the northern flank of the Ketley portion of this coal-field, and they follow the outline of the promontories of the trap and silurian rocks near Wellington, but are for the most part in an incoherent and decomposed state, and the district is also much obscured by gravel. The Lower Red Sandstone reappears at Woxeter, Preston-Boats,* Shrewsbury, and other places on the banks of the Severn.

It dips away in slightly inclined masses from various small patches of coal at Pitchford and Uffington; also near Longnor, where the coal-bearing strata of Le Botwood pass gently beneath the red strata of Condover and Stapleton. In that district these red sandstones enter deeply into the recesses of the bays, or denudations which have been formed at the north-eastern extremities of the Cambrian rocks, in many situations resting directly upon their vertical or highly inclined strata; while in others, as in various hollows near Cound and Pitchford, they are separated from the old rocks by thin patches and broken zones of coal. In all such positions, even at the north-western end of the Lowley

* At Preston-Boats, the upper part of the old quarries exposes thin bedded, hard, slightly calcareous beds, with small concretions of dark green impure limestone, closely resembling certain cornstones of the Old Red Sandstone. In the lower part of the quarry the beds become thicker, and consist of sandstones of deep red colour, with a few blotches of marl. It is from beds of this age, that the Abbey Castle, and many ancient buildings of Shrewsbury have been constructed. Though I have looked in vain for any trace of organic remains in these calcareous beds, we should never despair of such a discovery, when we recollect for how long a period the existence of organic remains was unknown in beds of similar structure in the Old Red Sandstone.

and Caradoc ridge, these sandstones where not obscured by coarse drifted gravel, are soft thick bedded building stones, usually lying in slightly inclined strata. In a quarry at Condover, about thirty feet of these beds dipping very slightly to the north-east, are arranged in the following descending order.---

1. Gravel; 2. Thin-bedded Sandstone; 3. Red, argillaceous Marl; 4. Sandstone; 5. Argillaceous Marl as above; 6. Sandstone; 7. Marls as above; 8. Thick bedded Sandstone."

Numerous other details are given from various districts showing the connection of the lower beds of New Sandstone with the coal measures and the older rocks; frequent impressions and fragments of coal plants have been discovered in the beds which form a covering to coal-bearing strata; many of the impressions of plants are in an imperfect condition, but Professor Lindley had no hesitation in referring them to the carboniferous epoch. In coal-fields the junction of the New Red Sandstone with the coal-bearing strata is often obscured by superficial detritus, but where the rock is laid open it is sometimes a dark red, soft, thin-bedded sandstone, made up of black and white grains, in a thin paste, with a few harder concretions and some blotches of red marl; at other times it is harder, more siliceous, and intractable. Sometimes the dolomitic conglomerate, the red sandstone, and the coal beneath it are found resting upon the inclined edges of the Silurian rocks. In the western extremity of Shropshire the lower new red sandstone is directly superposed to the coal measures and the new pits at Drillt, to the east of Oswestry red sandstone marl and shale have been penetrated to a depth of 100 yards before the first traces of coal measures were perceived, when after passing through several layers of impure carbonaceous matter the usual coal seams of the Oswestry field were reached, and are now largely worked.

The following is a recapitulation of the different groups composing the New Red System in the districts examined by Mr. Murchison.

1. Saliferous and gypseous marls with beds of sandstone,

constituting together the equivalent of the "Keuper" formation of the continent.

2. Sandstone and quartzose conglomerates, representing the Bunter Sandstein and Grès Bigarrè.

3. Calcareous conglomerate, equivalent to the dolomitic conglomerate of the south-west, and the magnesian limestone of the north-east of England, shown by Professor Sedgwick to be the representative of rocks known in Germany under the names of Zechstein, Rauchwacke, &c.

4. The lower New Red Sandstone, overlying the coal-fields of Staffordshire and Shropshire, equivalent to the Rothe-todte-liegende, and probably the lower beds of the Grès des vosges.

Mr. Murchison concludes his account of the New Red System by observing, that a practical acquaintance with its lower beds "is of vast national importance; for as these sandstones are now proved to graduate into the coal measures, we need not despair of eventually finding some of the most valuable coal seams of the central counties extending beneath them." It is unnecessary to remind the reader of the importance of determining the nature and character of the vast tracts composed of sandstones on all sides of the great alluvial plains of India; and whether these rocks belong to the Old Red or the New Red Systems, or to both, considering the importance of this subject in regard to India, we are satisfied that Mr. Murchison's work affords by far the best examples of the peculiarities of these rocks, and of the methods for conducting our researches towards the discovery of their equivalent types in India; we shall therefore continue to follow him through the course of investigation he has pursued, and endeavour to exhibit the results of his researches in future numbers of our Journal. We may thus put the India geologist in possession of details and examples of the manner in which his inquiries may be conducted with effect, no where to be found but in the work of Mr. Murchison, which from it's size and price could not have a very general circulation in India.

With regard to the purely scientific part of the details given by Mr. Murchison on the subject of the New Red Sandstone, that author observes, that his inquiries may "lead geologists to modify their previous theoretical views respecting the relations of the coal measures to the overlying rocks, founded on what must now be considered local phenomena, observed chiefly in the Bristol district and south-western parts of England; where because the New Red Sandstone reposes unconformably upon the carboniferous strata the belief became prevalent, that this arrangement was indicative of a general rupture, subsequent to the accumulation of the coal measures, and anterior to the deposition of the magnesian limestone and conglomerate. That such, however, has not been generally the case, has been established with regard to the north of England, by the writings of Professor Sedgwick; and the preceding facts teach us the same lesson in respect to the central counties. for it is clearly demonstrated, that beds of the age of the dolomitic conglomerate are there separated from those of the carboniferous system by an unbroken succession of intermediate strata of vast thickness, of which there are few or no traces in the south-western parts of the island.

"Notwithstanding, however, the distinctions which have been drawn between the different members of the New Red System in the central counties, a question it is feared might still arise among foreign readers, concerning the true equivalent of the Rothe-todte-liegende: for as most continental geologists conceive that formation to be essentially connected with porphyritic and other rocks of igneous origin, they can scarcely peruse the description of the trappean conglomerate without supposing that those masses may represent the German deposit. If, however, we are to understand the foreign synonym to express a series of strata, elaborated in such a manner, as in some cases completely to connect the carboniferous and overlying system; then it is clear we must consider the Lower New Red Sandstone to be its true and full equivalent, even should it not contain a single pebble of trap. That it contains few or no fragments of trap in the north of England, has already been proved by Professor Sedgwick, and the same fact is now established in the central counties. Whilst, on the other hand, the great trappean conglomerates have been shown to overlie this equivalent of the Rothe-todte-liegende, and to be on the same parallel with the dolomitic conglomerate. Referring to former opinions on this point, Professor Sedgwick has well observed, 'In comparing the Bristol and Exeter conglomerates

with the Rothe-todte-liegende, our geologists made use of the best evidence with which they were acquainted. But the New Red Sandstone group is now better understood; and in future comparison with continental deposits of the same age, we should use as our types those sections which are most complete, instead of the Bristol or Exeter overlying groups, in which more than one half of the series is absolutely wanting.

"The trappean ridges of Malvern, Abberley, and Clent, will be described in the sequel; but in the mean time it may be observed, that as the red conglomerates on their flanks contain angular and rounded fragments of the trap composing those hills, the rocks from which such debris was derived must have been in existence before the conglomerate was formed. Now, the rupture between the New Red Sandstone and the carboniferous deposits, as marked by the dislocations along the line of the Abberley Hills, would certainly lead us to suppose, that the eruptions which gave rise to these hills took place, either during the accumulation of the upper coal measures, or of the Lower New Red Sandstone; for, without anticipating explanations which are to follow in the ensuing chapter, it may be asserted, that nothing is more consistent with modern and ancient analogies, than that such volcanic eruptions should have been mere local phenomena, which in the tracts where they prevailed (Devon, Abberley, Clent, &c.) may have occupied the place of the Lower New Red Sandstone, by interfering with its deposition, while in the tracts not visited by these outbursts, the formation would naturally be fully developed, and would there exhibit the unbroken connexion between the New Red and Carboniferous Systems which has been detailed in the previous pages."

Before going into the description of the coal measures, Mr. Murchison devotes a chapter to Trap Rocks. Ninety years have scarcely elapsed, he observes, since two French academicians collecting plants among the hills of central France, were astonished by discovering numerous cavities resembling the craters of volcanoes. From the lips of these cavities currents of lava, as fresh in aspect as if they had flowed yesterday, were traceable into the neighbouring vallies, following their sinuosities and stopping their ancient water-courses, and moulding themselves into the inequalities of the actual surface. To complete the analogy with

active volcanoes, most of the mineral substances composing these lava currents were found to be similar to those of Vesuvius and Etna. When M. Guettard, one of the naturalists, first announced these discoveries, so unwilling were men of science to believe in phenomena of which neither history nor tradition had preserved a record, that scepticism long prevailed. More recent discoveries in Iceland, South America, and Asia Minor have brought to notice all the evidence that can be required to convince us not only of the similarity of modern and ancient volcanic eruptions, says Mr. Murchison; but also of the *great extent* to which such phenomena have prevailed. "But Auvergne is not merely replete with analogies of modern volcanic regions, it was further found to contain many rocks which though from their characters must have been formed from igneous agency, are yet in many lithological features dissimilar from modern lavas, whilst they resemble many of the so-called trap rocks"; thus a succession of periods of eruptions and of long intervals of repose have impressed on the various currents of lava and deposits from lakes and rivers, which in a succession of beds occur in central France, such character as to enable the inquirer to carry backward his researches from the connecting links of existing phenomena, into volcanic operations of high antiquity.

Mr. Murchison adduces the instance of Graham's island on the coast of Sicily, to prove the vast influence of volcanic agency and the manner in which the results are modified by the sea under our own observation Soundings had proved the sea to be 600 feet deep where the island rose to an elevation of 200 feet above the sea, measuring three miles in circumference; yet in three months from its first emergence it again disappeared, and a year after, when the spot was surveyed, a dangerous reef, eleven feet under water, was all that remained. Thus Mr. Murchison concludes that volcanic

eruptions to the extent to which they must have existed in the early history of the planet could not have occurred without producing striking changes in physical geography.

The volcano and the earthquake are said by Mr. Murchison to be, the one a "safety valve" by which heated matter escapes at intervals from the interior, the other is the shock which lacerates the earth when the heated matter and its vapour is denied an access, and the task of the geologist is to read off the proofs of successive eruptions amidst the ruins they occasion.* Mr. Murchison then alludes to the observations of Hutton, Playfair, Hall, and others, to prove that syenites, porphyries, green stone, clink stone, and basalts are of igneous origin, but as this is now pretty generally allowed, we may pass over this part of the work. Mr. Murchison however adduces numerous circumstances, the result of his own researches, to prove that the basalts which have overflowed and dislocated the coal-fields must have been erupted subsequently to the period of the New Red Sandstone, while other great epochs of disturbance took place anterior to the deposit of the Old Red and Carboniferous rocks. The types of the Silurian system and the associated volcanic

* To afford an illustration of the manner in which geologists estimate the antiquity of rocks; let us suppose that fishes were buried in the ruins or debris of Graham's island, when the light materials of which it was composed, were scattered over the bottom of the sea, by the violence of currents. If by some future convulsion, that part of the sea should be raised up so as to compose dry land, and so many ages to elapse as to destroy all record of the change, except such as the remains of fishes imbedded in the rocks would afford, of the latter having been formed beneath the sea; the future geologist would then institute a comparison between the remains of the fishes, and such species as might live in his day; if he found them correspond, he would conclude the change from sea to land to have been comparatively recent, but if many of the fossils presented the characters of species unknown in his day as inhabitants of any part of the globe, he would conclude that they belonged to forms that have become extinct, and from all he could gather regarding the period of duration assigned to species, he would form his calculations as to the period in the earth's history at which Graham's island was overthrown.—ED.

rocks have remained, says Mr. Murchison, so clear, that the geologist has in them a record never to be mistaken. Thus Professor Sedgwick has pointed out bands of prophyry interstratified with slates, the whole of which have been subsequently pierced by other intrusive masses of igneous origin, thus evincing two widely different periods of igneous action.

[To be continued.]

Dr. Wight's *Illustrations of Indian Botany.*

We have recently received the XIIIth No. of the "Illustrations of Indian Botany," by Dr. Wight, and the XIIIth and XIVth Nos. of "Icones Plantarum Indiæ Orientalis." The object of these works is, as our readers are aware, to supply the means of reference to the student in Indian Botany at the cheapest possible rate, consistently with due accuracy of the plates, which are necessarily very numerous.

The first is intended, as the author expresses it, to explain the principles of grouping plants according to their natural affinities, and illustrating these by figures of each group. The second is intended to afford figures of Indian plants described in the author's "Prodromus Floræ Peninsulæ Ind. Orientali," an octavo work in two volumes, containing more information on the subject of Indian Botany than all the costly quarto, atlas, and folio volumes that have been hitherto published, with this additional advantage—that it may be had for *ten rupees.* Even the "Icones" intended to illustrate the "Prodromus" appears in monthly numbers, each containing ten quarto plates, lithographed under the author's eye for *one or two rupees.* The grand object being to give to India, so far as the limited resources of a private individual will permit, that which England has so long enjoyed in "Smith's English Botany,"—a standard work of reference, at the lowest possible price.

With the "Prodromus" and the two works now in course of publication, the student would be in possession of a botanical

library which would only require the addition of "Roxburgh's Flora Indica" to be nearly complete. The cost of the four books in question would we think hardly exceed 50 rupees, while they might all be packed in a writing desk of ordinary dimensions; so that whoever desires to make himself acquainted with Indian plants in India, where the knowledge is of most consequence, must be indebted to Dr. Wight for the means of accomplishing his object. We regret to see a list of subscribers to the "Icones" short of one hundred, even including the 50 copies taken by the Madras Government. This is perhaps owing to those only subscribing who have the author's "Prodromus," but surely there is no reason why we might not all have that work, while we could adduce a thousand reasons to prove its value to every one desirous of making himself acquainted with the plants of this country. Even without the "Prodromus" we can conceive the "Icones" would be highly useful, as with every number there is a closely printed quarto page or two, containing the characters of all the species figured.

In the present number of the "Illustrations" the author finishes the *Leguminosæ* and reviews the *Rosaceæ*, *Salicariæ*, *Rhizophoreæ*, *Combretaceæ*, *Memecyleæ*, and *Melastomaceæ*, &c. pointing out whatever of importance in their uses, or peculiar in their structure, that has fallen under his observations. To this number we also find a preface and introduction attached. In the first of these the author points out the object of the work, and offers some judicious observations on the advantage of the natural, over the artificial arrangement of plants: and in the second, the author shows what the natural arrangement is at present in regard to Botany. On this subject we are scarcely entitled to form an opinion, but we congratulate Dr. Wight on his successful labours in the investigation of natural affinities, and trust that the support which the works in which he is now engaged will meet within India, may promote his fortune as much as they are sure to raise him in the respect

and esteem of scientific men. We regret to observe subscribers are but few from this part of India, which we trust has been from some oversight, as we are acquainted with no books that ought to have a wider circulation in India, whether we regard the subject, the manner in which it is treated, or the claims of the author.

Meteorological Observations. By Mr. J. M'Clelland.

During the hot weather in all parts of India that we have been in, subject to the influence of westerly winds, there is a remarkable haze which lasts from April till the rains set in about June. We have heard it ascribed to an electric state of the atmosphere by some, and by others to an unknown condition of the air indicative of sickness and approaching famine, especially if unusually intense or long continued.

The great fault of most persons in interpreting phenomena of this nature is, that they look too far for their causes. Heat and dryness may be favourable circumstances for the development of electric phenomena, but that the atmosphere is more charged with electric fluids during the hot weather than at other seasons, or that such is the cause of the haze, we have as little reason for supposing as we have in ascribing to it any mysterious influence over either our health, or the fecundity of the earth.

It is solely attributable to the high temperature of the air, and the geological structure of the tracts over which the prevailing winds pass, as is proved by the earthy precipitate from the atmosphere, which takes place at night, when the winds subside.*

After the first fall of rain, the peculiar effects above noticed disappear, the rain is ushered in with storms of thunder and wind, and the quantity that falls during the succeeding three months is never less than 25 inches, and often as

* Inquiries in Kemaon, page

much as 38 inches in the plains. In districts along the base of the mountain ranges on the Malabar and Malay Coasts, as well as along the whole North-eastern frontier, the fall of rain is greater, although the lower strata of air in which we live in Bengal is far more saturated than in districts where the fall of rain is greater. We cannot therefore calculate by means of rain-guages and other similar means, how the condition of a climate in regard to moisture affects its salubrity, and hence much of the mystery malaria presents to us. It may indeed be questioned, whether excessive humidity in low flat countries is not itself sufficient to develop similar effects on the constitution of man to those we refer to malaria, without resorting to any more active or mysterious agency. In India, it is after inundations and rains subside, that intermittents most prevail; is this universal? if not, what are the circumstances of exceptions? But let us satisfy ourselves that humidity itself is not the cause of intermittents, before we go further and ascribe them to more subtile agency. It would be very easy to argue one way or other on such a question, but we ought to discard opinions, and even all evidences short of direct inferences from such facts as are not opposed to other facts. We cannot gain a knowledge of the operations of natural causes without being acquainted with nature, and recording the results of observations as we advance. The investigation of the causes of endemic diseases and the physical effects of climate on the human constitution, is one of the most beneficent and profound subjects of inquiry; and though it concerns us more than any other question in which the mind can engage, yet it ever has been, and ever will be, more neglected than other subjects, simply because those who are most competent, have least leisure to investigate it; and it is unfortunately considered by philosophers to be exclusively the province of the physician, to whom they are consequently too much disposed to leave it.

The phenomenon of mists in Bengal depends on two causes; and the season during which they are liable to

occur, is from the end of November to the beginning of April. The *mists* of November and December depend on different causes from those that give rise to the *fogs* of February and March. The first arise from the peculiar influence of radiation, and the second from diurnal variations in the winds.

During the day the surface absorbs heat from the clear rays of the sun in proportion to the degree of moisture contained on it. If the surface be arid, the absorption of heat will be great under the action of the sun's rays, but when these are withdrawn, the radiation and cooling will be equally rapid and great; hence the diurnal variations of dry sandy tracts, as the desert of Scind, will necessarily be great, but here the atmosphere and the surface are both dry together. In Bengal, on the other hand, where a larger proportion of the surface is covered with water and vegetation, the moisture of the air is greater and the dew-point consequently lower, and wherever this last happens to come within the sphere of diurnal variation, precipitation must take place.* Since the extremes between the lowest and highest diurnal temperature is greater on clear open spaces than in forests, it is in the former we commonly perceive a thin horizontal stratum of vapour suspended of a morning at sunrise over the surface.

Fogs, on the other hand, are more general, and arise from diurnal changes of the wind. The south-west monsoon generally sets in as a southerly wind about the beginning of March or the middle of February; it is naturally moist, and blows steadily during the day, when the temperature of the air, and consequently its capacity for moisture is greatest, subsiding gradually after night-fall; from this hour till sun-rise temperature gradually diminishes, and we find every thing enveloped in fog. Night fogs which are not uncommon about the change of the monsoon, when the winds are variable,

* The diurnal variation in Calcutta during the N.E. monsoon amounts to as much as 30°.

may be explained in the same way; the only difference is, that the necessary cooling before a fog can take place, is occasioned in this case by a light northerly wind of sufficiently low temperature setting in at night-fall, producing the same effect as radiation in reducing the temperature of the atmosphere.

Fogs during the day in the plains of India rarely happen, because the temperature of the atmosphere at the surface is such as to raise the dew-point above the influence of ordinary changes of temperature.

The diurnal variation of temperature in Calcutta during the north-east monsoon amounts to 30° Fahr. and the dense mists which float along the surface about sun-rise may be ascribed to the absorption of more moisture into the atmosphere from low tracts during the day when the temperature is highest, than can be held in an invisible form at sun-rise when the temperature is lowest, while these causes, together with others dependent on the state of the prevailing winds occasion mists.

Such changes are however only observed in the open air. In houses the variation of temperature is checked to within a range of 10° Fahr. and where houses closely adjoin each other, their effect is communicated to the open air so as to prevent the formation of mists and fogs in their immediate vicinity. In removing a thermometer from our house to the open air beyond its influence at sun-rise, we have found the mercury suddenly fall from 75° to 64° or from 64° to 50°, according to the season. It is only such houses as are built of brick or stone that display this effect in resisting diurnal extremes of temperature in Bengal. Forest trees however have a similar effect but in a minor degree, a fact the recollection of which might be useful in forming new stations where houses of the best description cannot be built at once, and fine forest trees often occur.

The diseases here most common to man during each of the *three* seasons, may be stated to be fevers during

the rains, visceral and organic diseases in the cold, and epidemics during the hot months. The greatest proportion of sickness is probably during the rains, that of death during the cold months; cholera however has for the last three years been a regular attendant on the accession of hot weather. It is easy to see from the few facts thus thrown loosely together how much the study of meteorology, when directed to the natural history of the atmosphere might improve our knowledge of diseases. We know so little of the influence of external nature over the animal economy that we cannot be surprised that our knowledge of the cause of disease should remain nearly stationary, and that what we announce as discoveries to-day should be upset by some new opinion to-morrow. The difficulty is to make people sensible of the necessity of feeling their way with a view to the elucidation of some specific point.

Remarks on an undescribed species of Civet. By MR. J. M'CLELLAND.

The zoologist has no greater difficulty to encounter in the mere descriptive part of his duty than in drawing just conclusions as to the specific value of characters in animals nearly allied to each other, and there is nothing of more importance to know, than the amount of variation nature is capable of assuming in a single form, and the circumstances to which such variations are due.

We should not generally lay any great stress on slight shades of difference in colour, but there are some groups in which the distribution of particular spots and markings on the external covering is of much more importance than in others. In the *Feræ*, or Cats, for instance, as well as in their corresponding types throughout the animal kingdom, we often observe each species distinguished not merely by the number, size, and colour of spots, but by the particular forms these assume on various parts of the body. It is

curious also to observe this law of *isographism*, if we may use such an expression, the more constant in those species whose form and habits approach nearest to each other, and which it would consequently be most difficult to distinguish but for the constancy of some peculiar marks. Until the time of Buffon, the difference between the Civet and the Zibeth was unobserved, both being of nearly the same form and colour, but the number of dark marks on the tail being different in the two, might have earlier led to a comparison of the number and form of the vertebral bones of which the organ is constructed, when a difference we may presume would have been detected that could only be accounted for by the ordinary laws of variation in animals of distinct species. Strange to say, however, that long after the difference between the animals in question had been first suggested, naturalists preferred dealing in opinions to searching for facts; and so slow is the discovery of truth, that it required some thirty years to reconcile naturalists to what they had been unaccustomed to suppose in this instance.

The Civet (*Viverra civetta*) is most abundant in the hottest parts of Africa and in Abyssinia, where the animal is reared and an extensive trade carried on in *civet*, a peculiar odoriferous substance like musk, once very fashionable in medicine, and also as a perfume.

The Zibeth (*Viverra zibetta*) has been found in the Philippine Islands, from whence the animal figured and described by M. F. Cuvier seems to have been brought; but it is said also to belong to India, but on what authority I have not the means of ascertaining.

Colonel Sykes found *Viverra rasse*, Horsf. in the woods of the table lands east of the western ghauts,* and *V. indica*, a very nearly allied species to the latter, in the forests of the western ghauts. More recently Mr. Hodgson of Nipal mentions both these species as inhabitants of the Tarai.† The species figured in Hardwicke's Illustrations as *Viverra ben-*

* Proc. Zool. Soc. 14th Feb., 1832. † Ib. Proc. 26th Aug. 1831.

galensis, Gray, seems to be *V. indica,* Geof. It appears probable therefore that naturalists have fallen into a mistake in supposing *V. zibetta* to be an inhabitant of India, i. e. Hindustan, and we shall probably be able to account for the manner in which the error, if it be one, has arisen.

In a collection of about 200 animals of different kinds recently formed by the plant collectors employed by our friend Mr. Griffith in the Kasyah mountains, is an animal which corresponds partly with *V. zibetta,* Gm. in the distribution of colour and size, but it has a shorter tail with only six complete broad black rings, and a broad black band passing below under the throat in addition to two black stripes on either side of the neck. As this animal corresponds nearly with the colour of the Zibeth, and is of the same size and form, we may presume that it has been supposed to be the same species. Without attempting to describe this animal fully, we beg to offer a few more remarks regarding its peculiarities.

Throat white, with black band passing from the ear backwards under the neck, a second interrupted black band on the side of the neck, and a third passing along either side of the nape and descending in front of the shoulder with a black streak along the spine, forming a short mane. There are six broad black rings encircling the tail. Head grey, with a dark spot on the base of the outer side of the external ear, general colour grey, darker above than below. The sides are streaked transversely, the streaks longitudinal on the hind quarters and shoulders, becoming closer and darker on the limbs, which are nearly black. The length of the tail is thirteen inches, length from the tail to the snout two feet nine inches. Height about thirteen and a half inches.

The tail of this animal is about the same length as that of *V. civetta,* but the black rings which surround it are broader, and this last peculiarity also removes it still farther from *V. zibetta;* in which the rings on the tail are more

numerous and incomplete. It also differs from *V. civetta*, in having a white throat, and from *V. zibetta*, in the neck being crossed below by a black band. Should it prove a new species, as we have no doubt it will, we trust that its name may be connected with that of the distinguished botanist to whose liberality we are indebted for the first knowledge of its existence; and who, while employed himself in one extremity of India, can find means for supporting, and time for organising establishments for collecting natural productions in another.

The different animals of the Civet kind are in India called *Catàs;* there is one in Bengal, probably *V. indica*, Geof., which is very common, and has been known even to enter houses in Calcutta at night in search of poultry. A few months ago an instance of the kind occurred in a house surrounded by a high wall, and in which there were several dogs. The Catàs on finding itself pursued, entered a large pond, and appeared to rely with much confidence on its dexterity in the water for its safety.

On two undescribed species of Skate, or Raidæ. By MR. J. M'CLELLAND.

We are acquainted with five species of *Raidæ* inhabiting the waters of Bengal, though nothing seems to have been written about them. Buchanan describes one, *Raia sancur*, without a caudal sting or spine; it ascends in the Ganges, he observes, as high as Cawnpore, and attains a great size; I have not yet met with the species alluded to by this author. I am therefore much inclined to suspect it to be the *Wolga tenkee* of Russel, a species whose tail is armed with a spine, but from the estimation in which this is held by the Hindus as a charm, it is generally removed before the fish is brought to market; should this conjecture prove correct with regard to Buchanan's species, it may become doubtful whether any species of stingless Rajæ (*Anacanthus*

Ehrenb.), inhabits India. Russel describes ten species, of which we have three in Bengal, namely, the *Tenkee kunsul*, Russ. *Isacurra tenkee*, id. and the *Wolga tenkee*, id. The following are two additional species to the three we have just mentioned, which all belong to Bengal.

MYLIOBATIS DUMER.

MYLIO. MACROPTERA, J. M. t. 11. f. 1.

A Myliobatis with an elongated depressed oval snout; the breadth of the body and pectorals equal to twice its length, and the length of the ventral fins at either side of the insertion of the tail equal to a third length of the body. Tail equal in length to twice the breadth of the body and pectorals. Dorsal placed at the base of the tail, and in front of a narrow pointed sting.

TRYGON ADANS.

TRYGON VARIEGATUS, J. M. t. 11. f. 2.

A Trygon with the upper surface of the body variegated like tortoise-shell, and covered with osseous tubercles, with one large tubercle on the back, and a serrated sting on the upper third of the tail; the tail is slender, without a fin, and equal to thrice the length of the body. Its breadth is about twenty inches. This is a very beautiful species, and is found in the Salt-Water Lake near Calcutta.

The first belongs to the singular group of *Skates* called Sea-Eagles, and is a good deal like the figure given in Hardwicke's Illustrations of Indian Zoology as *Myliobatis maculatus*, but the dorsal and ventral fins which are placed at the base of the tail are short and rounded, while in the species here described they are longer and angular.

The second is a very beautiful *Trygon*, or Sting-ray, of which we can find no account in authors, we have therefore described it as a new species.

DESCRIPTION OF PLATE. II.

FIG. 1.—MYLIOBATIS MACROPTERA; 1. a. Lower part of the head; 1. b. lower view of the ventrals and base of the tail.

FIG. 2.—2, a front view of the head, shewing the altitude and breadth of the body; 2. b. lower part of the head; 2. c. lower part of the body; 2. d. the osseous tubercles on the centre of the back, natural size.

Desiderata in the Entomology of India. By the Rev. F. W. Hope, F.R.S. &c. *privately furnished to* Dr. Cantor, *who has requested us to give them publicity.*

1.—Parasites of Birds, Lice, (*Nirmi*). Parasites of *Reptilia* (*Acari*) the name of the genus and species should be given on which they are found. Parasites of Quadrupeds, Ticks, &c.

2.—Endeavour to ascertain if the larger Beetles of India live more than one year; it is important also to ascertain the sexes of the *Atlas Beetles*, and the uses to which their horns are applied.

3.—Ascertain the names of the trees which yield *Resin Anime;* and if any other resins in India contain insects.

4.—Among *Coleoptera*, attend chiefly to the *Lamellicorn Beetles*, *Cetonia*, *Copris*, *Scarabæus*, and *Baprestidæ*.

5.—Ascertain by dissection of gigantic *Coleoptera* if the organs of hearing are in the basis of the antennæ as in *Crustacea;* collect the larvæ of all large *Beetles*, and try if they have the power of hearing.

6.—Send me an account of the habits of *Paussus*, and all the species you can obtain.

7.—Any species of insects infested with worms, should be noticed. The worms should have drawings made of them before put into spirits.

8.—All hermaphrodite insects to be noticed, as well as irregular copulation of different genera.

9.—All *Carrion Beetles* to be attended to. They are supposed to be *scarce* in India. The prejudice of caste and of religion will not allow many of the natives to touch a dead body of any animal.

10.—All species of silk-bearing insects used in commerce, with their local names and larva, eggs, &c. It is probable we may breed the Atlas Moths in England. Send Larvæ of any, placed in mould, when an opportunity occurs. Colonel Withill introduced alive into England *Bombyx Selene*. Any reports of the annual produce of silk useful.

11.—*Cochineal*, new species; intelligence wanted about its range. How many species in commerce in India. *Lac insect* also.

12.—*Bees*. All species of Bees to be collected. Any accounts of the produce of honey. The *native names* of Bees much wanted; any thing remarkable in the combs to be figured. All *parasite Beetles* found in Bees' nests much wanted. Imports and exports of honey and wax. What are the Bees which produce the wax of the Chinese candles? there are several sorts.

13.—*Ants*. Collect all species of Ants—males, females, and neuters. Ascertain if they *lay up* stores of grain, seeds, &c.; be careful in marking the species. What Ants will drive out the White-Ants? Are the different kinds employed by the natives, to drive out those which annoy them? Experiment on the formic acid. If the White-Ants' nests are ever used as ovens.

14.—*White-Ants*. Collect all species; attend to their parasites, particularly the *Beetles*, which attack them, and are found in their nests.

15.—What insects are eaten as food? Their Indian names. What *Locusts* are eaten, &c.?

16.—Mark those insects which cause any particular destruction of crops, and if the destruction is periodical.

17.—Mark all *luminous* insects. Ascertain if the *Lantern Fly* is *luminous*, it is disputed.

18.—What species of *Mygale* are in India? Their habits. What spiders yield silks, such as are found in commerce?

19.—What species of vesicatory insects are used in India? If any besides *Lytta* and *Mylabris*. If any insects are used medicinally. Their names.

20.—Record any instance of death occasioned by insects, by Bees, Wasps, Hornets, or by Flyblowing, &c. Any ailments produced by insects swallowed in the larva state, &c.

21.—Is *Resine Anime* a preservative against the attacks of insects? Said to be used in corking bottles. Is cloth *coloured by Indigo* ever attacked by the White-Ants and other insects?

22.—Any native remedies against Cockroaches? Collect all species of, and particularly all sorts of *Earwigs*.

23.—Native remedies used after the stings of insects, and the attacks of Gnats, Scorpions, Centipedes, &c.

24.—Note all insects infesting houses. Does any true *Ptinus* occur in the East Indies?

25.—Species of *Æstrus* attacking quadrupeds; collect them. Do any attack man in the East?

26.—Collect all Aquatic Beetles. Do the *Gyrene* of India emit a peculiar smell? Do the *Carabe* emit an ammoniacal odour?

27.—Collect all Land-Crabs and inland *Crustacea*.

28.—Observe particularly the insects which destroy corn, rice, and all stores. What checks are in use?

29.—Note any extraordinary migration of Caterpillars, and indeed of all other insects.

30.—The *Mole Cricket* of the East Indies. What are its habits?

31.—Note the appearance of the clouds of Locusts.

32.—What are the preservatives used by the Indians in guarding their feathers and shawls? Colocynth supposed to be used.

33.—What genera and species of insects are used by the natives, in necklaces and ornaments, &c.?

34.—The habits of the large *Stag Beetles*. Do they destroy leaves?

35.—Note all odorous smelling insects.

36.—Are Beehives in use in India? Send specimens of domestic Bees, if they are domesticated.

37.—Is the *Sherifah*, or Custard-Apple seed, injurious to vermin? Flies are reported never to settle on the tree or its fruits. Ants will attack both.

38.—From what quarters chiefly do clouds of Locusts come?

Proceedings of the Zoological Society.

November 27, 1838.—Lieut.-Colonel W. H. Sykes in the Chair.

Dr. Horsfield laid before the Meeting a series of Mammalia and Birds collected in India by John M'Clelland, Esq., Assistant Surgeon E.I.C.S., and proceeded to point out the characters of some which were undescribed.

A paper on the Fishes of the Deccan, illustrated with numerous coloured drawings, was read by Colonel Sykes.

"In submitting to the Society an account of the fishes of Dukhun," observes Colonel Sykes, "it will scarcely excite surprise, that out of 46 species described no less than 42 are new to science, since they are from a hitherto untrodden field, and from peculiar localities, on the great plateau of the Dukhun (Deccan), none of them coming from a less elevation than 1500 feet above the sea; many from near 2000 feet, and others from yet higher situations. The chief features in the collection are the paucity of orders to which the collection belongs, and the remarkable prevalence of the members of the families of *Siluridæ* and *Cyprinidæ*. There is but one apodal *Malacopterygian*, but 4 *Acanthopterygii*, and the whole of the rest of the fish belong to the order Abdominal Malacopterygians. Of the families there are only eight: *Percidæ*, *Scombridæ*, '*Pharyngiens Labyrinthiformes*,' *Gobiadæ*, *Siluridæ*, *Cyprinidæ*, *Esocidæ*, and *Murænidæ*, comprising 15 genera and 9 sub-genera, including one sub-genus, which I have been compelled to add to the *Cyprinidæ*. An attempt has been made to methodize and distinguish the multitudinous members of the families of *Siluridæ* and *Cyprinidæ*. The fact is, the continued inosculation in the character of the teeth, of the *cirri*, of the spines (serrated or not) of the fins, the armature of the head, and the position of the fins in the *Siluridæ;* and the number of *cirri*, and form and position of the fins in the *Cyprinidæ*, together with the character of the mouth, produce such approximations in species to each other, and in individuals of one genus to another, that not only is there infinite difficulty in determining the genera of the fishes of these families, but their identity as species is occasionally not less difficult. Some of my *Siluridæ* do not exactly correspond with the generic characters of the genera of this family as now constituted, and I might have added to the number of genera; but to this I have an objection, unless as an evidently necessary measure. In the *Cyprinidæ*, however, I was

obliged to set aside my repugnance, for three species were not referrible to any one even of the numerous sub-genera which Buchanan Hamilton wished to establish. It only remains to state that the whole of my fishes were drawn from absolute measurement, and have a scale of size attached to each figure; they were caught in the various rivers on whose banks I encamped, as individuals were required; so that my draftsman, who worked constantly under my own eye, never had to finish his drawings from shrivelled and discoloured specimens. I have to a great extent adopted the names by which the fishes are called by the Mahrattas as specific names, so that naturalists who travel the country can always obtain them.

Ord. Acanthopterygii.

Fam. Percidæ.

Ambassis, Agass.

Amb. Barlovi, Sykes. An *Ambassis* with the two back fins united, with the first ray indented on the edge, and containing 7 spines, and the second 14 spines; all the spines longer than the membrane, with 18 rays longer than the membrane in the anal fin, and with a short vertically compressed diaphanous body.

Closely allied to *Changa Ranga* of Hamilton. 'Fishes of the Ganges.' This fish is dedicated to our Secretary.

Fam. Scombridæ.

Mastacembelus, Gron.

Mast. armatus, Sykes. A *Mastacembelus* with the fins of the tail, back, and vent united, with thirty-nine to forty short sharp bony spines along the back, and two behind the vent.

This fish has not the exact generic characters of *Macrognathus*, *Mastacembelus*, or *Notacanthus*, and might probably constitute a genus between the two last.

Fam. 'Pharyngiens Labyrinthiformes,' Cuv.

Ophicephalus, Bloch.

Oph. leucopunctatus, Sykes. An *Ophicephalus* with from 51 to 53 rays in the dorsal, and 6 in each ventral fin, and with the rays of the dorsal and anal fins undivided; the pectoral fins ending in a central point, and the fish covered with white dots.

I have never known this remarkably fine fish crawl on shore or in the grass, as some species of the genus are said to do. It is excellent eating.

Fam. Gobiadæ.

Gobius, Linn.

Gob. Kurpah, Sykes. A *Gobius* with 7 rays in the first dorsal fin, 11 in the second, which is of similar size with the anal fin; 19 in the pectoral, and 10 in the anal fin.

In different individuals of this species I have found the number of rays in the fins slightly differ. Of a sweet flavour.

Ord. Malacopterygii Abdominales.

Fam. Cyprinidæ.

Cyprinus, Linn.

Cyp. Abramioides, Sykes. A *Cyprinus* with 20 rays in the dorsal, 8 in the anal, and 18 in the pectoral fins, without tendrils, with tuberculated nose, red edged fins, and with a red lunule on each scale.

This very fine fish is called Tambra by the natives, from the general prevalence of a copper colour over it. Attains the length of 21 inches and more height 7 inches. Is excellent eating.

Cyp. Potail, Sykes.

A *Cyprinus* proper, deep and fleshy, slightly compressed without tendrils, with the dorsal fin of 13 rays, pectoral of 14, and anal of 9. Scales large and silvery; length 10 or more inches; height $3\frac{1}{4}$ inches.

Cyp. Nukta, Sykes.

A *Cyprinus* with two tendrils on the under jaw, and with two short horns or bosses on the space between the eyes, which together with the deflected upper lip are tuberculated; large scales.

In the judgment of my friend Mr. Yarrell, to which I subscribe, this very singular fish is considered a monstrosity of *Cyp. auratus*. Dr. Rüppell, who did me the favour to look over my drawings, expresses the same opinion. Found very abundantly in the Inderanee river 18 miles north of Poona. It is called Nukta (or nob) by the Mahratta fishermen.

Varicorhinus, Rüppell.

Var. Bobree, Sykes. A *Varicorhinus* with tuberculated nose, without tendrils; with 17 rays in the dorsal, and 8 in the anal fin; with the form of a tench.

It may be a question whether this is not a real Labeo of Cuvier, with long dorsal, no spines or cirri, and thick fleshy lips frequently crenated; size 6 inches by $1\frac{6}{10}$ high.

Barbus, Cuv.

Barb. Mussullah, Sykes. A *Barbus* with 12 rays in the dorsal, 8 in the anal, and 16 in the pectoral fins, with the mouth furnished with 4 very short *cirri*, and tuberculated nose; sometimes 3 feet and more long, and a foot high, and weighing 42 pounds.

Found in the Goreh river.

Barb. Khudree, Sykes. A *Barbus* with 4 *cirri*, blood-stained fins, large hexagonal scales, elongated body, and with 14 rays in the dorsal, 14 in the pectoral, and 7 in the anal fins.

Found in the Mota Mola river, 8 miles east of Poona.

Barb. Kolus, Sykes. A *Barbus* with 13 rays in the dorsal fin, 8 in the anal, and 10 in the ventral; with moderate-sized scales; with callous tubercles on the head, and a short *cirrus* at each corner of the mouth.

This fish shows the difficulty of drawing up generic characters to embrace all the species of a genus. Having only 2 *cirri*, it should not be a Barbel; but having *cirri* at all, it does not belong to the next genus *Gobio*;---moreover, it has a spine in the dorsal.

Chondrostoma, Agassiz, the first division of the genus *Leuciscus* of Klein. Dorsal fin in the centre of the back.

Chond. Kawrus, Sykes. A *Chondrostoma*, without lateral line, tubercles, or *cirri*, with 12 rays in the dorsal, 8 in the anal and 16 in the pectoral fins.

A sub-cylindrical fish found in the Beema river; grows to a foot in length, but is usually smaller. Proportion of length to height in one specimen, 6 inches by $1\frac{4}{10}$ inch.

Chond. Fulungee, Sykes. A *Chondrostoma*, with dorsal fin of 10 rays, anal 6, and pectoral of 10; of an elongated, not much compressed shape. Length about a foot; height 4 inches.

Chond. Boggut, Sykes. A *Chondrostoma*, without tendrils or tubercles on the nose, with 12 rays in the dorsal, 15 in the pectoral, and 8 in the anal fin; body of an elongated form. Length from 7 to 11 inches; height $1\frac{3}{4}$ to 2 inches.

Chond. Mullya, Sykes. A *Chondrostoma*, with a short, obtuse head, without tubercles or tendrils; sub-cylindrical body, with 11 rays

in the dorsal, 14 to 16 in the pectoral, and 8 in the anal fins; a red process or protuberance on the snout between the nostrils. Length 5 to 6 inches; 1½ to 2 in diameter.

Chond. Wattanah, Sykes. A *Chondrostoma* of an elongated form, without tubercles or tendrils, with the dorsal fin high, and having 11 rays: and 9 or 10 in the ventral, and 8 in the anal fin; sub-cylindrical form. Length 4¼ inches, height ¾ of an inch.

Found in the Beema river.

Chela, Buchanan Hamilton. A sub-genus of *Leuciscus*, with the dorsal fin very far behind over the anal; straight back, and nose on the level of the line of the back.

Chel. Balookee, Sykes. A *Chela* of the size of a minnow; back straight; body elongated; dorsal fin situated far back, and having 8 rays, 14 rays in the anal, and 12 in the pectoral fins. Length 3 inches.

Very sweet eating, the bones as well as other parts. Common in all the rivers.

Chel. Oweni, Sykes. A *Chela*, with straight back, elongated and vertically compressed body; dorsal fin situated far back, with 11 rays, 12 in the pectoral, and 19 in the anal fins, with scales so minute as to be scarcely discoverable. Length 5 inches; greatest size 7 inches.

Found in most of the rivers. The *Cyprinus Cultratus* of Bloch would appear to be the type of the sub-genus.

I have dedicated this fish to my friend Mr. Owen, the distinguished naturalist.

Chel. Jorah, Sykes. A *Chela*, with straight back, convex belly, dorsal fin far behind; size of a large minnow; with 10 rays in the dorsal, 12 in the pectoral, and 8 rays in the anal fin. Length about 4 inches, height $\frac{8}{10}$ths. of an inch.

Excellent eating. Found abundantly in the Beema river near Pairgaon.

Chel. Teekanee, Sykes. A small *Chela*, with nearly straight back; snout on the continuation of the line of the back; belly arched;

with 10 rays in the dorsal, 12 in the pectoral, and 14 in the anal fins. Length $2\frac{1}{4}$ inches, height $\frac{3}{4}$ inch.

Found in the Beema.

Chel. Alkootee, Sykes. An elongated, silver-white, slightly compressed, minute *Chela*, with the dorsal fin about 8 rays, very far back; ventral of about 7, and anal of about 10 rays, with burnished silver gill covers and black orbits; rarely more than an inch long, and not much thicker than a good sized crow quill.

This very beautiful fish has a sweet flavour.

Leuciscus, Klein. First division. The dorsal situated a little behind the centre of the back, above the space between the ventral and anal fins.

Leuc. Morar; Cyprinus Morar, Buchanan Hamilton. A *Leuciscus* allied to *Chela*, but with the dorsal fin a little behind the centre of the back, with 8 rays in each ventral fin, 12 in the anal, and 10 in the dorsal, and with the edge of the belly smooth. Length $4\frac{3}{4}$ inches; height $\frac{1}{10}$.

Differs slightly from Buchanan Hamilton's *L. Morar*.

Leuc. Sandkhol, Sykes. A *Leuciscus*, with nearly cylindrical body; dorsal fin of 12 rays, pectoral of 14, and ventral of 10 rays; gibbous head; 8 to 10 inches long by $1\frac{1}{4}$ to 2 inches high; eyes with whitish narrow irides. The dorsal in this fish is situated a little *before* the centre of the back.

Found in the Goreh river at Kullumb.

Leuc. Chitul, Sykes. A *Leuciscus*, with 14 rays in the dorsal, 14 in the pectoral, and 8 in the anal fins; of a reddish grey colour, and rounded head. Sub-cylindrical. Length about 5 inches, height $1\frac{1}{2}$ inch.

Found in the Inderanee river near Chakun.

It being found impracticable to arrange, in any of the sub-genera described, the following fishes of the Carp family, it is proposed to place them in a new sub-genus, which I will call by the native Mahratta name of Rohtee.

ROHTEE, nov. genus.

Carps with a lozenge-shaped body, rather long dorsal and anal fins, the former seated on the angle of the back with the first complete ray serrated posteriorly; scales minute.

Rohtee Ogilbii, Sykes. A *Rohtee*, with 12 rays in the dorsal, 9 in the ventral, and 17 in the anal fins; the body very compressed, and very high, with the back sloping to each end from the centre; head sharpish; pectoral fins, narrow acuminated. First complete dorsal ray, a strong bone, serrated behind. Length $4\frac{1}{2}$ inches, height $1\frac{1}{2}$ inch. A bony fish.

Found in the Beema river near Pairgaon. This fish is dedicated to my friend Mr. Ogilby, a distinguished member of the Society.

Roht. Vigorsii, Sykes. A *Rohtee*, with armed dorsal fin of 11 rays, ventral of 10, and anal of 28 rays; compressed body; high in the middle, and sloping to each end; head slightly recurved; eyes very large. Length, 6 inches; height, $1\frac{9}{10}$ inches; greatest length, 8 inches.

Found abundantly in the Beema river at Pairgaon. I have dedicated this fish to my friend Mr. Vigors.

Roth. Pangut, Sykes. A *Rohtee*, compressed, deep, angular-backed, with 12 rays in the dorsal, 14 or 15 in the pectoral, and 8 in the anal fins, and with the first 3 or 4 rays of the dorsal fin black at their tips; scales larger than in the preceding species. Length, 5 inches; height, $1\frac{1}{4}$ inch.

Found in the Baum and Beema rivers.

Roht. Ticto; Cyprinus Ticto of Buchanan Hamilton. A *Rohtee*, $1\frac{1}{2}$ inch long, with 4 to 6 black spots on the body; the 2nd ray of the dorsal toothed behind with sharp incurved teeth; with 10 rays in the dorsal, 8 in the anal, and 8 in the ventral fins; pectoral fins narrow, acuminate.

Found in the Mota Mola at Poona. This fish differs slightly from Dr. Buchanan Hamilton's *Cyprinus Ticto*.

Cobitis, Lin.

Cob. Rüpelli, Sykes. A nearly cylindrical scaleless *Cobitis*, not much thicker than a large goose-quill; from 2 to 3 inches long with 6 *cirri;* the lateral line marked with short brown bars, and the

rays of the dorsal and anal fins similarly barred; dorsal fin of 13 rays, pectoral of 12, and ventral of 8 rays.

This fish is much esteemed for food. Found in the Beema river at Taimbournee and Mota Mola near Poona. I have dedicated this beautiful little fish to Rüppell, who did me the favour to look over my drawings, and at the same time gave me his opinion respecting the genera of the fishes.

Cob. Mooreh, Sykes. Differs from the preceding only in being of a smaller size, in having 12 rays in the dorsal, and 7 in the anal fin; the head is more obtusely pointed, and there are more dark blotches on it; the bars on the lateral line are differently arranged.

Cob. Maya, Sykes. Differs from the first species in having a spine under each eye, and in having a blunter head; 9 rays in the dorsal, 7 in the ventral fins.

Fam. *Esocidæ*.

Belone, Cuv.

Bel. Graii, Sykes. A *Belone* with the fin of the tail rounded and emarginate, with both jaws elongated into a quadrangular beak, with very minute scales; dorsal of 16 rays and anal of 16 rays; closely allied to the *Esox Cancila* of Buchanan Hamilton.

I have dedicated this fish to a gentleman well known for his contributions in natural history.

Fam. *Siluridæ*.

Schilbe, Cuv.

Sch. Pabo; Silurus Pabo, Buchanan Hamilton. A *Schilbe*, with the tail divided into 2 unequal lobes, both pointing downwards; with 4 *cirri*, 2 shorter than the head, and with from 68 to 70 rays in the anal fin. Length from 12 to 15 inches, height 2¼ to 3 inches.

Found in most of the rivers. Differs slightly from Buchanan Hamilton's *Silurus Pabo*. No second dorsal.

Sch. Boalis, Silurus Boalis, Buchanan Hamilton. A *Schilbe*, with the fin of the tail divided into 2 unequal lobes; with 4 *cirri*, of which 2 extend to the middle of the fish; all the fins unarmed; dorsal of 5 rays, pectoral of 15; ventral fins very small, of 9 rays; anal fin of 84 rays. 'Attains the length of 3 feet, and the weight of 8 lbs.

Found in the Mota Mola at Poona. Differs slightly from the *Silurus Boalis* of Buchanan Hamilton. No second dorsal.

Hypophthalmus, Spix.

Hyp. Goongwaree, Sykes. An *Hypopthalmus* with 8 *cirri*, all longer than the head, but not extending to the middle of the fish; with 7 rays in the dorsal, and 52 in the anal fin, with an extremely minute second dorsal; first ray in the pectoral, and first in the dorsal, spinose and serrated behind. Greatest length 28 inches body vertically compressed.

Found in the Mota Mola near Poona.

Hyp. Taakree, Sykes. An *Hypophthalmus*, with 8 *cirri*, 2 of which reach to the ventral fins, 2 very minute near the nostrils, and 4 on the chin, nearly as long as the head; with the first dorsal and pectoral rays serrated on the posterior edge, with 8 rays in the dorsal and 50 in the anal fin. Length, 9 inches; height, 2 inches.

Bagrus, Cuvier.

Bagr. Yarrelli, Sykes. A *Bagrus*, with the first rays of the pectoral and dorsal fins terminating in long fleshy tendrils and serrated behind; with 8 *cirri*, two of which are as long as the head, thick, fleshy, and being lateral elongations of the upper lip; other *cirri* very short; head broad, covered with a granulated bony plate; the fish olive brown, marked with black blotches like a Dalmatian dog; 2nd dorsal fleshy, triangular. Length, 18 inches, but attains to a very great size; body not vertically compressed.

Found in the Mota Mola at Poona.

Bagr. Lonah, Sykes. A *Bagrus*, with 8 small *cirri;* flat, granulated head; first dorsal fin of 7 rays, and pectoral of 10 rays, the first ray of which is furnished on the posterior edge with long sharp teeth; anal fin of 10 rays; 2nd dorsal of a triangular form and fleshy: something resembling the preceding in colour.

Platystoma, Agassiz.

Plat. Seenghala, Sykes. A *Platystoma*, with the tail fin crescent-shaped, lobes unequal; with 8 *cirri*, two of which only are longer than the head, reaching to two-thirds of the length of the fish; the first ray of the pectoral and ventral fins serrated behind; head long, flat, spatulate, covered with a granulated bony plate. Dorsal fin of 8 rays; high, ventral fins, very far back, of 6 rays. Grows to a great size; flesh heating and soft.

Phractocephalus, Agassiz. *Pirarara* of Spix.

Phract. Kuturnee, Sykes. A *Phractocephalus*, with 6 *cirri*, 2 of which only are longer than the head; the first pectoral spine serrated on both edges; the 1st dorsal spine on the posterior edge only; these two spines terminating in a filament: the shoulder-bone elongated into a point behind. Greatest length, 6 inches; dorsal fin of 7 rays; pectoral of 9 rays; ventral fin small, of 7 rays; second dorsal replaced by a small adipose fin.

Phract. Itchkeea, Sykes. A *Phractocephalus*, with 8 *cirri*, 2 of which from the upper lip, extend to the end of the pectoral fins;, the other 2 very minute, with the 4 on the chin nearly as long as the head; with the 1st ray in the pectoral fins only serrated, with 8 rays in the dorsal, and 12 in the anal fins; with a sharp prolongation of the scapula. Fish handsomely marked on the back with dark colours. Length, 2 inches.

This fish presents some slight deviations from the generic characters.

Phract. Gogra, Sykes. A *Phractocephalus*, with 4 shortish *cirri*; the plates of the shoulder elongated into acute, angular, broad spines, with a dorsal fin of 8 rays; first ray a bone serrated behind; pectoral fins of 10 rays, the first ray a broad compressed bone serrated on both edges; head flat and broad; second dorsal small, fleshy. Size 6 inches, but grows larger.

Pimelodus, Lacepede.

Pimelodus Seengtee, Sykes. A *Pimelodus*, with the caudal fin divided into 2 unequal sharpish lobes, and having 8 *cirri*, 2 of which reach to the tail fin, and 4 to the end of the head, and 2 are shorter than the head; the dorsal fin high and without spine, of 9 rays; 12 rays in the anal fin; the second dorsal adipose, and extending from the termination of the first dorsal to near the tail. Length of fish, 6 inches.

Ageneiosus, Lacepede.

Ageneiosus Childreni, Sykes. An *Ageneiosus*, without *cirri*, with the first ray of the dorsal and pectoral fins serrated on the *anterior* edge only; with 8 rays in the dorsal, and 42 in the anal fin; with two sharp lobes to the tail, the upper being somewhat the smallest. Length of fish, 18 inches; height, 4½ inches, but grows to a larger size. Second dorsal adipose, minute.

Fam. *Clupeidæ*.

Mystus, Buchanan Hamilton; *Notopterus*, Lacepede.

Mystus Badgee, Sykes. A *Mystus*, with not less than 105 rays in the anal fin, 7 or 8 in the dorsal, and in the pectoral from 13 to 16, all unarmed; without apparent ventral fins, and with a single small dorsal; the anal and caudal fins uniting, and terminating in a point at the end of the body; posterior edge of the last gill plate crenated; scales minute. This remarkable fish belongs to the genus *Mystus* of Buchanan Hamilton, but not to the genus *Mystus* of Cuvier. Fish vertically compressed. Length, 11 inches; height 3 inches.

Ord. Apodes.

Fam. *Murænidæ*.

Anguilla, Cuv.

Ang. Elphinstonei, Sykes. An *Anguilla*, with the lower jaw the longest; with the back, tail, and anal fins united, and with a broadish, flat head; body dark green, blotched with black; with 2 short tubular processes, one on each side of the upper jaw. Attains the length of 3 feet, and diameter of 3 inches.

I have dedicated this fine fish to the Honourable Mountstewart Elphinstone.

In concluding my characters of the fishes of Dukhun (Deccan), I may be allowed to state, that I have found the number of *cirri*, whether in the *Siluridæ* or *Cyprinidæ*, insufficient as a *generic* character; different species of the same genus varying in the number of the *cirri*."

February 26, 1839.—Rev. F. W. Hope, in the Chair.

A communication from the Bishop of Down and Connor was read, giving an account of *Antilope Philantomba*, Ogilb. lately brought from Sierra Leone, by F. W. Mant, Esq. Also a communication by Lieut. H. K. Sayers, on the habits of another species of Monkey from Sierra Leone.

At the request of the Chairman, Mr. Ogilby proceeded to make some observations upon a new species of Monkey, now living at the Society's Menagerie, which he characterized as follows:

Papio Melanotus. *P. cinereo-brunneus; capite, dorso, lumbisque subnigris; cauda brevissima, nuda; facie, auriculisque pallidis.*

The specimen from which this description is taken is a young male, said to have been brought from Madras. It has at first sight a consider-

able resemblance to the common Barbary species *(Papio sylvanus)* both in general colour and in physiognomy, but differs materially in the blackish brown shade which covers all the upper parts of the head, neck, shoulders, and back. The face and ears are of a pale flesh colour, not unlike the shade which distinguishes extreme age in the human species; the naked part of the paws is dirty brown, and the temples are slightly tinged with a shade of scarlet, which the keeper informs me spreads and deepens when the animal is feeding. The tail is about an inch long, very slender, and perfectly *naked;* but whether the last circumstance be not accidental I shall not take on me to say; it *appears,* however, to be the natural condition of the organ. The general colour of the sides, under parts of the body, and extremities, is that pale olive brown so common among other species of this genus, such as the Bhunder *(P. Rhesus),* the Maimon *(P. Nemestrinus),* &c., and the hairs are equally without annulations. The individual has all the liveliness, good-nature, and grimace of the young Magot (*P. Inuus* and *Sylvanus*); but, like that species, it will probably become morose and saturnine as it advances in age and physical development; qualities which, indeed, are common to all the Papios, and pre-eminently distinguish them from the Cercopithecs, Colobs, and Semnopithecs.

A paper, entitled "*Spicilegium Serpentium Indicorum,*" was communicated by Dr. Theodore Cantor. This paper contains the following descriptions of

A. Venomous Serpents.*

Genus Trigonocephalus, Oppel.

Trigonocephalus erythrurus. *Tri. supra læte viridis, squamis ovatis carinatis subimbricatis, cauda cinnamomea, squamis lævibus rhomboidalibus tecta; abdomine flavo-viridescenti linea nigra serrata utrinque incluso.*

Scuta abdominalia 167.

Scutella subcaudalia 68.

Habitat. Delta Gangeticum.

Bright green above, with ovate keeled slightly imbricate scales; the tail cinnamon-red, with smooth rhomboidal scales; the abdominal surface greenish-yellow, inclosed on both sides by a black serrated line.

Trigonocephalus mucrosquamatus. *Tri. superne, grisco-brunnescens,*

* Dr. Cantor's original specimens, drawings, and descriptions are in the possession of the Radcliffe Library, Oxford

annulis nigris albo marginatis, squamis ovalibus, semicarinatis, mucronatis, imbucatim tectus; subtus albidus, nigro punctatus.

Scuta abdominalia 218.

Scutella subcaudalia 91.

Habitat. Naga Hills, Assam.

Brownish grey above, with black white-edged rings, covered with oval, half-keeled, pointed, imbricate scales; whitish beneath, dotted with black.

Genus Bungarus, Daudin.

Bungarus lividus. *Bung. superne lividus, subtus albo-flavescens.*

Scuta abdominalia 221

Scuta subcaudalia 56.

Habitat. Assam.

Blackish-blue above, yellowish-white beneath.

Genus Hamadryas,* Cantor.

Hamadryas ophiophagus. *Ham. superne olivaceo-viridis, striis sagittalibus nigris cinctus, abdomine glauco nigro marmorato.*

Scuta abdominalia a 215 *ad* 245.

Scuta subcaudalia a 13 *ad* 32.

Scutella subcaudalia a 63 *ad* 71.

Habitat. Bengal.

Hindustanee name. Sunkr-Choar.

Olive-green above, with arrow-shaped black stripes; beneath, glaucous marbled with black.

Genus Naja, Laurenti.

Naja larvata. *Na. supra brunnea, striis subflavis transversalibus variegata; disco annulo albo, larvæ haud impari, ornato, pone quem (a tribus ad quinque) annuli albi;—inferioris superficiei pars anterior annulis albis, nigro-cœrulescentibus alternis circumdata, pars posterior glauco iridescens.*

Habitat. Bombay, Calcutta, Assam.

Bengallee name: Doollah-Kewtiah Nag.

Brownish, with numerous faint yellow transverse stripes; the hood marked with a white ring, not unlike the form of a mask, behind which there are from three to five white rings;—the anterior part of the lower surface with alternate white and bluish-black rings; the posterior part iridescent-glaucous.

* Vide Proceedings of the Zoological Society, No. lxvi. p. 73.

A young specimen of this serpent lives at present in the Society's Gardens in Regent's Park. The artificial temperature, 62° Fahr., in which it is kept appears to agree very well with the serpent, which in one respect offers a striking difference from the habits of this genus when kept in captivity in India, for the keeper informs me that it feeds occasionally upon living frogs and earth-worms, and that it drinks milk; while those in Dr. Russell's and in my own possession in India, when deprived of liberty invariable refused to take any kind of food.

Genus Elaps, Schneider.

Elaps Bungaroides.* *El. superne lividus, striis sagittalibus albis cinctus: infra albus alterne lividus.*

Scuta abdominalia 237.

Scutella subcaudalia 46.

Habitat. Chirra Punji.

Black-blue above, with white arrow-shaped stripes; beneath, alternately white and black-blue.

Elaps flaviceps. *El. capite flavo, dorso nigro vitta serrata alba cœruleo pallide nitente utrinque circumdato, cauda flava linea nigra media divisa;---abdomine flavo linea nigra utrinque incluso.*

Scuta abdominalia 275.

Scutella subcaudalia 45.

Habitat. Malacca.

The head yellow, the back with a serrate band on each side, shining with a pale sky-blue colour; the tail yellow, divided in the middle by a black dorsal line; the abdominal surface yellow, inclosed on each side by a black line.

On my late visit to Copenhagen, Professor Reinhard pointed out an undescribed species of Bungarus from Java, preserved in the Royal Museum of Natural History (MSS. Cat., No. 128), which exhibits the same distribution of colours as the *Elaps flaviceps*, viz. the head and tail of a light yellow, the back bluish-black, the abdominal surface light yellow, the scuta marked with a short black transverse band or check on each side.

Elaps nigromaculatus. *El. superne pallide brunneo-rubescens, maculis nigris alba-marginatis, lineis nigris junctis;---cauda fasciis duabus nigris*

* From its resemblance to *Bungarus cœruleus*, Daudin.

alba-marginatis cincla ; abdomine flavo albescenti, alterne livido, linea nigra serrata utrinque incluso.

Scuta abdominalia 238.

Scutella subcaudalia 24.

Habitat. Sincapore.

Pale reddish brown above, with black white-edged spots, united by black lines ; on the tail two black bands with white margins ;—the abdominal surface whitish yellow, alternately blue-black, inclosed on both sides by a black serrated line.

Elaps furcatus,* Schneider, Var. *El. superne pallide brunneo-rubescens, linea dorsali subflava nigro serratim marginata, cauda fasciis tribus nigris cincta, abdomine flavo albescenti, linea nigra utrinque incluso.*

Scuta abdominalia 238.

Scutella subcaudalia 24.

Habitat. Sincapore.

Pale reddish brown, above with a light yellow dorsal line, with black serrated margins; on the tail three black bands; the abdominal surface whitish yellow, inclosed on each side by a black line.

March 12, 1839.—William Yarrell, Esq., in the Chair.

Mr. Ogilby communicated a portion of a letter which he had received from M. Temminck. It related to two species of Monkeys, *Colobus fuligenous* and *Papio speciosus;* the former M. Temminck considers identical with the Bay-Monkey of Pennant, and he states that this opinion is founded upon its agreement with a coloured drawing now in his possession; this drawing having been taken by Sydenham Edwards from the specimen of the Bay-Monkey formerly in the Leverian Museum, and which is the original of Pennant's description.

The *Macacus speciosus* of M. F. Cuvier is stated by M. Temminck to be founded upon an immature specimen of a species of *Macacus* which inhabits Japan ; the habitat of Molucca Islands given by M. F. Cuvier being founded upon error. The specimen was originally taken from Japan to Java, where it died ; the skin was preserved, and M. Diard having obtained possession of it, sent it to the Paris Museum; and as there was no label attached, M. F. Cuvier imagined it to be a native of the place whence M. Diard had sent it.

* Russell, II., No. xix.

Mr. Fox exhibited several birds, which he stated had formed part of an extensive collection made in Iceland by the Curator of the Durham Museum.

The second part of Dr. Theodore Cantor's paper, entitled "*Spicilegium Serpentium Indicorum*," was read. In this paper numerous new species of Indian serpents are thus characterized :---

B. Innocuous Serpents.

Genus Calamaria, Linnc.

Calamaria sagittaria. *Cal. partim cinerea, partim ferruginea, serie dorsali punctorum nigrorum, nucha capiteque albicantibus, imagine sagittæ nigræ ornatis ; corpore squamis lævibus imbricatim tecto ; abdomine citrino, punctis lateralibus nigris, vitta livida utrinque incluso.*

Scuta abdominalia 224.

Scutella subcaudalia 69.

Habitat. Bengal, Tirhoot.

Partly ash-coloured, partly rusty-brown, with a series of black dots along the back; the head and neck whitish, with an arrow-shaped black mark; covered with smooth rhomboidal imbricate scales; the stomach of a citrine colour, with lateral black dots, and a blue black band on either side.

Vernacular name, Doblee.

Calamaria monticola. *Cal. olivaceo-fusca, collari læte flavo, linea dorsali albicante, abdomine citrino.*

Scuta abdominalia 125.

Scutella subcaudalia 44.

Habitat. Naga Hills in Assam.

Dark olive-brown, with a bright yellow collar and a whitish dorsal line; beneath of a citrine colour.

Genus Coronella, Boie.

Coronella albocincta. *Cor. viride-canescens, fasciis transversalibus albis nigro marginatis, quorum intervalla nigro punctata ; scutis abdominalibus albo-flavescentibus, alterne fuscis.*

Scuta abdominalia 181.

Scutella subcaudalia 65.

Habitat. Chirra Punji, Assam.

Greyish-green, with white transverse bands, edged with black, the intervals dotted with black; the abdominal scuta alternately yellowish-white and deep brown.

Assamese name, Patdei-hee.

Coronella violacea. *Cor. violaceo-rubescens, squamis albo-marginatis, subtus margaritacies.*

Scuta abdominalia 196.

Scutella subcaudalia 38.

Habitat. Rungpore.

Reddish-violet; the scales edged with white: beneath pearl-coloured.

Coronella cyclura. *Cor. viridè-canescens striis nigris obliquis interruptis, abdomine margaritaceo, vittâ tristi cinereâ utrinque incluso.*

Scuta abdominala 179.

Scutella subcaudalia 43.

Greyish-green, with black oblique interrupted stripes; the abdominal surface pearl-coloured, with a deep ashy-grey band on either side.

Vernacular name, Tukkr-Bora.

Genus Lycodon, Boie.

Lycodon atro-purpureus. *Ly. atro-purpureus albo nigroque marmoratus, abdomine margaritaceo.*

Scuta abdominalia 257.

Scutella subcaudalia 91.

Habitat. Mergui, Tenasserim.

Deep purple, marbled with white and black; beneath pearl-coloured.

Lycodon subfuscus. *Ly. subfuscus, abdomine albo flavescenti.*

Scuta abdominalia 245.

Scutella subcaudalia 78.

Habitat. Bengal.

Light brown; yellowish white beneath.

Vernacular name, Chittee.

Genus Coluber, Boie.

Coluber dhumna. *Col. olivaceo-viridis, squamis nigro-marginatis, abdomine margaritaceo, scutis scutellisque nigro-clavatis.*

Scuta abdominalia 187.

Scutella subcaudalia 119.

Habitat. Carnatic, Orissa, Bengal, Nepal, Assam, Arracan, Tenasserim.

Olive-green; the scales edged with black; the stomach pearl-coloured, edged with black.

Vernacular name, Dhumna or Dhameen.

Coluber porphyraceus. *Col. læte porphyraceus, lineis nigris transversalibus albo-marginatis, pone quas lineæ duæ nigræ dorsales, æquidistantes; subtus læte flavus.*

Scuta abdominalia 213.

Scutella subcaudalia 64.

Habitat. Mishmee Hills, Assam.

Bright porphyry-red, with black transverse lines edged with white, the posterior portion of the body with two black parallel dorsal lines: beneath light yellow.

Coluber quadrifasciatus. *Col. superne læte brunneo-viridescens fasciis dorsalibus* iv. *nigris, albo interruptis; infra flavus*

Scuta abdominalia 248.

Scutella subcaudalia 82.

Habitat. Assam.

Above light greenish-brown, with 4 black dorsal bands interrupted with white; beneath yellow.

Coluber curvirostris. *Col. supra partim læte olivaceo-viridis, punctis et lineis obliquis albis nigrisque, partim æneus; abdomine subfusco.*

Scuta abdominalia 220.

Scutella subcaudalia 85.

Habitat. Bengal.

Above bright olive-green, with white and black dots, and oblique bronze-coloured lines; beneath light yellow.

Vernacular name, Tukkr-Bora.

Coluber reticularis. *Col. superne brunneo-nigrescens, annulis albidis reticulatis, contiguis et lineis ejusdem coloris transversalibus ornatus, cauda brunnea nigrescenti, alterne griseo-flavescenti; infra griseo-flavescens nigro-maculatus.*

Scuta abdominalia 229.

Scutella subcaudalia 75.

Habitat. Chirra Punji.

Blackish-brown, with whitish confluent netted rings and transverse lines of the same colour; the tail alternately blackish-brown and yellowish-grey; beneath yellowish-grey spotted with black.

Coluber bipunctatus. *Col. supra triste vinoso-purpureus squamis albo bypunctatis, subtus albo-cœrulescens.*

Scuta abdominalia 181.

Scutella subcaudalia 52.

Habitat. Bengal, Assam.

Deep claret-purple above, each scale with two white dots, beneath bluish-white.

Coluber monticolus. Hodgson. *Col. superne luteo-rubescens fasciis transversalibus nigris, scutis abdominalibus albo-flavescentibus nigro marginatis.*

Habitat. Nepal.

Reddish dun-coloured above, with black transverse bands, the abdominal scuta yellowish-white, with black margins.

Subgen. Hurriah, Daudin.

Hurriah sanguiventer, (Coluber sanguiventer, Hodgson.) *Hur. superne vinoso-purpureus æneo nitens, abdomine sanguineo.*

Scuta abdominalia 207.

Scuta subcaudalia 11

Scutella subcaudalia 85.

Habitat. Nepal.

Above claret-purple, with metallic lustre; beneath blood-coloured.

Genus Herpetodryas, Boie.

Herpetodryas prionotus. *Her. supra fusco flavescens, nigro-punctatus, fasciaque dorsali serratâ nigricante; abdomine flavo, fascia serratâ nigricante utrinque incluso.*

Scuta abdominalia 153.

Scutella subcaudalia 65.

Habitat. Malacca.

Above yellowish-brown, dotted with black, and with a serrated blackish dorsal band; the abdominal surface yellow, with a blackish serrated band on either side.

Genus Psammophis, Boie.

Psammophis cerasogaster. *Psam. fulvus aureo pallidè nitens, squamis hexagonis rhomboidalibus summis carinatis, cæteris lævibus tectus; abdomine ceriseo, linea læte flava utrinque incluso.*

Scuta abdominalia 149.

Scutella subcaudalia 60.

Habitat. Bengal, Assam.

Yellowish-brown, shining with a pale gold colour, with hexagonal rhomboidal scales, the uppermost of which are keeled, the rest smooth; the abdominal surface cherry-coloured, with a bright yellow line on either side.

Vernacular name, Lal Mitallée.

Psammophis nigrofasciatus. *Psam. superne subflavo-rubescens fasciis latis transversalibus nigris, lineisque duabus barbatis dorsalibus ejusdem coloris, interstitium quarum nigro partim punctatum; abdomine albido.*

Scuta abdominalia 245.

Scutella subcaudalia 75.

Habitat. Sincapore.

Light-reddish-yellow above, with broad transversal black bands, and with two barbed dorsal lines of the same colour; the interval between these dorsal lines dotted with black; the abdominal surface whitish.

Genus Dendrophis, Boie

Dendrophis Boii.* *Den. superne nigro-brunnescens, vitta dorsali subfuscâ, abdomine albo-flavescenti vittâ ejusdem coloris utrinque incluso, rostro subobtuso.*

Scuta abdominalia 186.

Scutella subcaudalia 129.

Habitat. Bengal, Ceylon.

Brownish black, with a light brown dorsal band; the abdominal surface yellowish white, with a band of the same colour on either side; the rostrum subobtuse.

Vernacular name, Kalla Lawrýnca or Nawdunga.

Genus Dipsas, Boie.

Dipsas ferruginea. *Dip. supra ferrugineo-brunnea, nigro alboque rarè maculata; abdomine ferrugineo-flavo, albo nigroque maculato.*

Scuta abdominalia 171.

Scutella subcaudalia 57.

Habitat. Assam.

Rusty-brown, with a few black and white spots; the abdominal surface rusty-yellow, dotted with white and black.

* Chrysopelea Boii, Dr. Andrew Smith.

DIPSAS MONTICOLA. *Dip. supernè tristè fusca, striis aliquot nigris obliquis; infra flavo-brunnescens.*

Scuta abdominalia 193.

Scutella subcaudalia 82.

Habitat. Naga Hills (Assam).

Dull dark brown above, with a few black oblique stripes; beneath brownish-yellow.

Genus TROPIDONOTUS, Kuhl.

TROPIDONOTUS QUINQUE. *Tro. supernè grisèo-brunnescens, nuchâ numero Quinque* (v.) *nigro inscriptâ, fascusque duabus nigris dorsalibus, albo punctatis; abdomine flavo-albescenti, fasciâ nigrâ utrinque incluso*

Scuta abdominalia 259.

Scutella subcaudalia 97.

Habitat. Mergui.

Brownish-grey above, with the cypher V in black on the neck, and with two dorsal black bands dotted with white; the abdominal surface whitish-yellow, with a black band on either side.

TROPIDONOTUS MŒSTUS. *Tro. supernè tristè olivaceo-nigricans, subtus flavus.*

Scuta abdominalia 138.

Scutella subcaudalia 77

Habitat. Bengal.

Dull blackish olive-colour above; yellow beneath.

Vernacular name, Kalla Mittallee.

TROPIDONOTUS SURGENS. *Tro. læte olivaceo-viridis, abdomine flavo linea nigra serratâ utrinque incluso.*

Scuta abdominalia 148.

Scutella subcaudalia 23.

Habitat. Bengal.

Bright greenish-olive; the abdominal surface with a serrated line on either side.

Vernacular name, Bahr.

TROPIDONOTUS PLUMBICOLOR. *Tro. supra plumbeus, fascia sagittatâ occipitali nigrâ et albâ fascusqùe nigris serratis transversalibus, squamis alte carinatis tectus, mento albo, abdomine plumbeo.*

Scuta abdominalia 162.

Scutella subcaudalia 51.

Habitat. Malwa (Saugor).

Lead-coloured above, with an occipital arrow-shaped black and white band, and with black serrated transversal bands, covered with sharply-keeled scales, the chin white; the abdominal surface lead-coloured.

Genus Cerberus, Cuvier.

Cerberus cinereus. *Cerb. supernè cinereus fuscus nigris transversalibus, subtus albicans fasciâ nigrâ undulatâ.*

Scuta abdominalia 143.

Scutella subcaudalia 59.

Habitat. Bengal.

Ash-coloured above, with black transverse bands: beneath whitish, with a black undulated band.

Vernacular name, Jal Ginthea.

Genus Homalopsis, Khul.

Homalopsis olivaceus. *Hom. supernè olivaceus lineis nigris inter squamas variegatus, abdomine albicante, lineâ mediâ nigrâ diviso, vittâ albo-virescenti utrinque incluso.*

Scuta abdominalia 167

Scutella subcaudalia 71.

Habitat. Bengal.

Olive-coloured above, variegated with black lines between the scales, the abdominal surface whitish, divided in the middle by a black line, and with a greenish-white band on either side

Vernacular name, Metillee.

"The descriptions and figures of these serpents were made in India in 1835, 1836, and 1837. For the specimens from Assam I am indebted to the kindness of the eminent botanist Mr. William Griffith; for those from Chirra Punji, to the friendship of Mr. J. W. Grant, of Calcutta. I have also to acknowledge the liberality of Mr. Hodgson, the Hon. Company's Resident at the court of Nepal, who allowed me to publish the undescribed specimens in his collection of Nepalese serpents."

Ninth Meeting of the British Association for the advancement of Science.

Thursday, August 29.

Section A.—Mathematical and Physical Science.

The Secretary read the report of the Committee, consisting of Sir J. Herschell, Mr. Whewell, Mr. Peacock, and Prof. Lloyd, appointed to represent to Government the resolutions adopted by the Association in August 1838, at Newcastle, recommending that Magnetic Observatories be established in various parts of the British dominions, and that a naval expedition be fitted out for the purpose of determining, by obser-

vations, the magnetic direction and intensity, in high southern latitudes, between the meridians of New Holland and Cape Horn.

The successful result of the exertions of the Committee, and the admirable Report drawn out by the Royal Society, for the guidance and instruction of the officers engaged in the expedition, and which we so lately published (*Athen.* Nos. 616, 617), have so far anticipated the interest which would otherwise have attached to this paper, that we are reluctantly compelled, in the present crowded state of our columns, to pass it over.

'On certain Points in the Wave-Theory, as connected with Elliptic Polarization, &c.' by Prof. Powell.---The object of this communication is to lay before the Section a general statement of some material conditions which involve in a common relation the theory of dispersion, of the wave-surface, and of elliptic polarization. These have been the subject of some difference of opinion, and are still involved in considerable difficulty and apparent contradiction; a brief and clear statement of those points may, perhaps, tend to their better elucidation and ultimate solution. All the investigations set out from these equations of motion.---

$$
(A)\left\{
\begin{aligned}
\frac{d^2\xi}{dt^2} &= \Sigma\left\{\begin{array}{l}\phi(r)\ \Delta\xi \\ +\psi(r)\ \Delta x[\Delta x\Delta\xi+\Delta y\Delta\eta+\Delta z\Delta\zeta]\end{array}\right. \\
\frac{d^2\eta}{dt^2} &= \Sigma\left\{\begin{array}{l}\phi(r)\ \Delta\eta \\ +\psi(r)\ \Delta y[\end{array}\right. \\
\frac{d^2\zeta}{dt^2} &= \Sigma\left\{\begin{array}{l}\phi(r)\ \Delta\zeta \\ +\psi(r)\ \Delta z[\end{array}\right.
\end{aligned}
\right.
$$

By certain developements of $\Delta\xi\ \Delta\eta\ \Delta\zeta$, these forms involve as factors of products such as

$$\Sigma\,[\psi(r)\Delta x\ \Delta y]\ \&c.$$

If these sums are $=o$, the expressions are brought into forms in which they are directly integrable, and we have for solutions :---

$$
\begin{aligned}
\xi &= \Sigma\,[\alpha \sin (nt-kp) \\
\eta &= \Sigma\,[\beta \sin (nt-kp) \\
\zeta &= \Sigma\,[\gamma \sin (nt-kp)
\end{aligned}
$$

which are shown to involve such a relation between n and k, as gives the formula for the dispersion.

This condition, which I call (B), reduces the equation (A) to the form---

$$
(C)\left\{
\begin{aligned}
\frac{d^2\xi}{dt^2} &= \Sigma\ \left\{[\phi(r)+\psi(r)\Delta x^2]\Delta\xi\right\} \\
\&c. &= \qquad \&c. \\
\&c. &= \qquad \&c.
\end{aligned}
\right.
$$

And it corresponds to the supposition that the molecules are so arranged with respect to the axes $x\ y\ z$, that the sums with opposite signs destroy

each other. It is on this supposition alone that all the principal investigations proceed, from which the theory of dispersion is derived. And in all these investigations we consider a rectilinear displacement or vibration, which may be generally in any direction, and whose resolved parts in the direction of the three axes are $\xi\ \eta\ \zeta$ respectively. This may apply to all cases of unpolarized or plane-polarized light. But for elliptically (including circularly) polarized light, it is necessary to consider, not a rectilinear, but a curvilinear displacement or vibration, which is the result of *two* virtual rectilinear displacements acting at right angles to each other, and in a plane transverse to the direction of the ray, and one always in a phase retarded behind the other by an interval (b). In this case, therefore, it is necessary to proceed by making one of the co-ordinate axes (as x) coincide with the ray, and $\xi=o$, $\Delta\xi=o$, &c., while the other two in y and z coincide with the components, which give the elliptic vibration, and are of the forms—

$$\eta = \Sigma\,[\alpha \sin (nt-kx)]$$
$$\zeta = \Sigma\,[\beta \sin (nt-kx+b)]$$

This case, I believe, was first considered by Mr. Tovey. Pursuing the investigation thus, taking the axes generally as in any direction whatever, with respect to the arrangement of the molecules, it appears from Mr. Tovey's paper, ('Journal of Science,' No. 71,) and from the somewhat simplified form in mine ('Phil. Trans.' 1838, part 2,) that in the case of elliptic polarization, the condition (B) cannot hold good; while for common or plane polarized light it must hold good. The distinction therefore between the different states of light as to polarization, depends on this characteristic or criterion, which I call (E). The discussion between Mr. Tovey and Mr. Lubbock ('L. & E. Phil. Mag.' Dec. 1837, Jan. 1838,) seems to turn upon these propositions:—1. That every system of molecules (constituted as supposed in all these investigations) has at every point three axes of elasticity, whatever be the peculiar arrangement of the molecules. 2. That if we take these axes for the axes of co-ordinates, then the equations of motion are reduced to the form (C), or the condition (B) holds good. 3. This form of the equation is necessary for the investigation of the wave-surface: or at least, so much so, that without it the deduction is immensely complicated. At all events, the universal existence of such axes is essential to the nature of the wave-surface. Now, since these considerations are essential to the application of the theory to all media, it follows that in all cases there are certain axes in reference to which the condition (B) holds good. This, then, appears at direct variance with the distinction established above, or the criterion (E). And if we set out with equations (C), and pursue a train of deduction similar to Mr. Tovey's or mine, we find corresponding formulæ, but from which the conclusions in question cannot be derived. It appears, then, essentially important, that this discrepancy should be cleared up, and the fallacy, if any, detected.

'On the Temperature of the Earth in the Deep Mines of Lancashire and Cheshire,' by Mr. Eaton Hodgkinson. These experiments were made with thermometers belonging to the Association, and in the prosecution of them the author has been very greatly assisted by the proprietors of pits and others connected with them, who have kindly undertaken to observe the results themselves---thus saving the author the trouble, in some cases, of going more than once into the mine. The object of the experiments was to forward the views of the Association---which were, to obtain, from observations made in various places, and at different depths, some additional knowledge of the internal temperature of the earth. In the salt mines of Messrs. Worthington and Firth, at Northwich, in Cheshire, latitude about 53° 15′, a thermometer placed in a bore hole, 3 feet deep in the rock, 112 yards below the surface, indicated a temperature of 51° to 51¼° Fah., and varied little or nothing between summer and winter. In the deep coal mines of Messrs. Leeses, Jones, & Booth, near Oldham, a thermometer, placed in a bore hole as before, 329½ yards below the surface, varied from 57° to 58½° Fah., from observations made for a whole year, by Mr. J. Swain. In the Haydock colliery, 201 yards deep, about eighteen miles west of Manchester, and differing from it but little in latitude, the temperature varied considerably, both in the same hole and in different ones, but approached to 58°. The cause of these anomalies the author has not discovered. The experiments were made for him by Mr. William Fort. Other experiments are in progress. The latitude of Manchester is 53° 30′, and the mean temperature of the air there is 48° Fah., from Dr. Dalton's experiments.

Prof. Stevelly asked Mr. Hodgkinson, whether it was possible that water could have access to those parts in which his thermometers had been placed, particularly those placed in the stratum next under the coal, at the floor of the mine?---Mr. Hodgkinson thought not.---Prof. Stevelly said, that the reason why he inquired was, that there were certain kinds of coal, which when exposed to the action of water developed much heat. This was the case with all coals which contain pyrites. The substance of which the floor of the mine was composed, though nearly as hard as a metal, had such an affinity for moisture that even the hygrometric moisture of the air would decompose it, and of course develope more or less heat.---Prof. Forbes said it had been clearly established that coal mines were improper localities for making observations on subterranean temperature.

The President said, that as the Report which was next on the list was nearly allied in subject to the one at present under consideration, it would perhaps be convenient to permit it to be read, and to discuss both at the same time.

'Report on Observations on the Temperature of the Earth at different depths, made near Edinburgh, by Prof. Forbes.---These observations were commenced in Feb. 1837, and have been regularly continued since. They were instituted at the expense of the British Association;

and the result of two years' reductions was presented to the Section.* The object was to ascertain the conducting power for heat of different soils, and the measure of the sun's influence at different depths under similar *external* circumstances. The stations and soils were,

Observatory.	*Experimental Garden.*	*Craigleith.*
Trap Tufa.	Pure loose sand.	Compact coal-formation sandstone.

At each station four thermometers were sunk to the depths of 3, 6, 12, and 24 *French* feet respectively, the tubes of each being carried above the surface, so as to be conveniently exposed side by side. The readings were made every week, and corrected for the temperature of the stem and scale, and the results were projected in the form of curves, from which the following deductions have been made:—

I.—Annual Report.

	3 Feet (French).				6 Feet.		12 Feet.	24 Feet.		
									Sand.	Sand-stone.
1837. Fahr.					14 95	13 9	9.4		2.1	4 1
Cent		11.23			8.30		5 22	0.80	1.16	2.28
1838. Fahr.	17.7	20.33	18.52	11 2	14.57	14 25	9.3	1.25	1.88	3.83
Cent		11.30	10 29	6.22	8 10	7.91	5.16	0.70	1.05	2.13

These numbers involve the data for computing the Conductivity of these several strata; for the range in each case is found (as theory indicates) to diminish in geometrical progression, as the depths increase arithmetically, and the common ratio of the progression depends on the value of $\sqrt{\frac{\text{Specific heat}}{\text{Conductivity}}}$, which is the value of B in the following formula $\Delta_p = A + B_p$.

Where Δ_p is the range, and p the depth from the surface. To obtain the value of B, the above ranges were projected, and logarithmic curves drawn through the points, so as to satisfy approximately the observations at each station; the result is shown for the year 1838 in the subjoined figure, from which it will be seen that the experiments are perfectly consistent with one another, although (as at first sight might be expected) the amount of the range does not follow the same order of magnitude in the three soils at different depths.

The values of B, thus deduced, are—

	Trap.	Sand.	Sandstone.
In 1837......	—.0545	—.0440	—.0316
In 1838......	—.0641	—.0517	—.0345

* Some account of the first year's experiments has already been presented to the Royal Society of Edinburgh, and printed in their Proceedings.

The difference of these numbers, such as it is, is evidently not attributable either to errors of observation or to the inadequacy of the experiment to afford consistent results; a comparison of the curves for two years, in which every observation is projected, shows the most minute general conformity in their flexures and intersections. It is rather probably to be attributed to the observations having been commenced too late in the winter of 1836-7 to obtain the true minimum for that period, from which circumstance the superficial range would come out too small, and B would therefore be diminished, as it is in each of the three cases.

From the observations of 1838 we deduce farther this important result, that the oscillations of annual temperature would be reduced to $\frac{1}{100}$ of a Centigrade degree (or virtually extinguished) at a depth of

49 feet in trap tufa.
62 feet in incoherent sand.
91 feet in compact sandstone.

The differences in the value of B determined by various observers (varying in the results quoted by M. Quetelet in his excellent memoir on this subject, from — .0526 to — .0384) do not depend upon difference of geographical position, but on the various constitutions of the soil operated upon, a circumstance hitherto wholly neglected.

II.—Epochs of Maximum and Minimum Temperature.

	3 Feet (French).			6 Feet.			12 Feet.			24 Feet.		
	Trap.	Sand.	Sand-stone.	Trap.	Sand.	Sand-stone	Trap.	Sand.	Sand-stone.	Trap.	Sand.	Sand-stone
Minimum :												
1837 ……	Mar. 31	Mar. 23	Mar. 20	Apr. 9	Apr. 5	Mar. 26	May 6	Apr. 30	Apr 10	July 26	July 12	May 18
1838 ……	Feb. 26	Mar. 3	Feb. 23	Mar. 14	Mar. 19	Mar. 3	Apr. 20	Apr. 22	Mar. 20	July 18	July 8	May 12
Maximum :												
1837 ……	Aug. 6	July 31	Aug. 5	Sept. 2	Aug. 24	Aug 19	Oct. 17	Oct. 6	Sept. 11	Jan. 8	Dec 30	Nov. 11
1838 ……	Aug. 8	Aug. 6	Aug 16	Sept. 6	Aug. 31	Aug 23	Oct. 19	Oct. 14	Sept. 19	Jan. 5	Jan. 4	Nov 2

These dates, derived by graphical interpolation, are only approximate.

The progressive retardation of epochs as we descend is too evident to require to be pointed out. The maximum occurs 5¼ months after that of the air in the two first-named strata, whilst the conducting power of the sandstone is so superior as to accelerate this epoch by seven or eight weeks, compared with the trap or loose sand. Were this result deduced from thermometers placed at one depth only, its exactness might be doubted. It is derived, however, also from the intermediate ones.

By a simple graphical method it is easy to deduce approximately the rate *of propagation* of heat downwards in each of these soils, resulting from the whole observations taken together. The observations at different depths confirm one another; but the minimum in 1837 was, as

already stated, too imperfectly observed for the upper thermometers to be of much service. The remaining observations afford the following results :---

Soil and Locality,	Time of propagation of heat through One foot (French), deduced from			
	Maximum, 1837	Minimum, 1838.	Maximum, 1838.	Mean.
Trap (Observatory)	7 5 days	6.5 days	6 8 days	6.9 days
Sand (Exp. Garden)	7 1 —	5 8 —	6.8 —	6.6 —
Sandstone (Craigleith)	4 9 —	3.6 —	3.6 —	4.0 —

These results confirm the relation of conducting powers indicated by the constant B already found; but the numerical comparison of these independent results is a matter of extreme complication---(see Poisson, *Théorie de la Chaleur,* chap. xii.)

The President congratulated the members on the results likely to flow from experiments conducted on so well-digested a system. Any person who was conversant with the writings of Fourier, and other foreign writers on this branch of mixed mathematics, must be aware how necessary it was to be in possession of a sufficient store of well-ascertained facts, on which any theory, if it be sound, must rest and be dependent. The facts now collected were almost as complete as could be expected or desired; that those are not merely accidental variations of temperature which are indicated, must be observed on the most superficial examination of the three curves. The general conformity, while the thermometers, of whose indications they were as it were the types, were placed at such distances and in substances differing so materially in structure and physical character, together with the reproduction of curves in successive years so coincident in their general characters, were circumstances tending to stamp with the character of truth the results, and to show the soundness of the system on which these researches had been conducted. Theory had long been in advance of practical knowledge on this subject, but practice was now coming up and beginning to take her proper place as the handmaid and sure assistant of theory. Heretofore, the scale upon which experiment had been performed on the conducting power of the several substances of which the crust of our earth is composed, were on so small a scale that the analyst scarcely knew whether he was safe in using their results. In every point of view, then, they were most important.—Mr. Snow Harris observed, that an inspection of these curves would lead to the conclusion that, as the depth increased, their curvature diminished, and that therefore at some certain depth they would turn into straight lines, and the temperature at that depth become constant.—Prof. Forbes said that not only did this appear obviously from an inspection of the curves, but

also the formulæ which he had investigated and placed on the board indicated it.

'On the Progress of the Meteorological Observations at Plymouth, with the Barometer and Thermometer,' by Mr. Snow Harris.---The pressure of our atmosphere, as indicated by the barometer, being affected in these latitudes by many accidental circumstances, it is not without difficulty we are enabled to trace the great periodical variations, and exhibit them as they would appear in an undisturbed state. It is only by a careful and extensive series of observations, such as those now in progress in various places under the direction of the British Association, that we can hope to examine successively great periodical variations in atmospheric pressure, and bring them under the dominion of general laws. The great periodical variation, as shown by the horary oscillation, observed by Humboldt in the tropics, and by other philosophers in different parts of Europe, is undoubtedly a phenomenon of high interest in meteorology. In discussing the hourly observations with the barometer at Plymouth, Mr. Harris has shown that this phenomenon is distinctly traceable amidst a vast mass of accidental fluctuation. He exhibited the mean hourly pressures for the years 1837 and 1838, and the mean of the two years, and showed that a double wave was apparent, when these points were connected by a continuous line. The points in the waving line thus produced had been each determined from 730 observations; the whole number of observations from which the mean pressure had been deduced being 17,500. The following general results were then mentioned:---The mean height of the barometer at the Plymouth dockyard, 60 feet above the level of the sea, and at a mean temperature of 60° of Fahrenheit's scale, was from the latest results 29.8967. It occurred in the mean hourly progression four times in the day, viz. at 2, 20, and 8, 10, A.M.; 12, 30, and 6, 15, P.M.,—at which times the waves crossed the mean pressure line. The difference on oscillation from 5 to 10 A.M. amounting to .0113 of an inch, between 10 A.M. and 3, 30, P.M. amounted to .0118. The hours of greatest pressure were 10 A.M. and 9 P.M. The hours of least pressure, 5 A.M. and 3 P.M. Of the diurnal semi-waves, the ascent in the morning is the least, and the ascent in the evening the greatest. Of the descending branches of the curves, that during the day is less than that during the night. The times of the oscillations differ. The wave, by day, viz. that between 5 A.M. and 3, 30, P. M. being ten hours and a half. That by night, viz. between 3, 30, and 5 A.M. being thirteen hours and a half. The size of the daily wave, therefore, so far as the observations hitherto proceeded, was less than that of the wave at night. Mr. Harris proceeded then to discuss the observations as applied to the different seasons, of spring, summer, autumn, and winter, and showed that the general hourly progress of the pressure was greatly interfered with at particular periods; the wave of autumn being that which coincided most nearly with the general curve. Of the different monthly pressures, October

and December were the greatest, November and February the least, January and September the two nearest the mean.

Mr. Harris now proceeded to discuss the supposed Influence of the Moon on the Barometer, and with this view had reduced about 4,000 of the observations, so as to show the pressure at the time of the moon's southing, and for each hour before and after; but he could not discover any differences which could be supposed to arise from the moon's influence. He was therefore disposed to agree with the conclusion lately arrived at by Mr. Lubbock, from a discussion of the Barometric Observations at the Royal Society—viz. that no lunar irregularity is observable from this method of discussing the observations—that, if at any time established, it must prove extremely small. He could not, however, avoid mentioning, as a singular coincidence in the results of the two years, that taking the mean pressures about the four periods of the lunar changes, it appeared that the pressure was less at the new moon, and that it increased up to the last quarter, when it was the greatest. The first object being to arrive at certain great periodical variations, those had been principally kept in view; hence, mere accidental disturbances remained as yet unconsidered. Mr. Harris, however, had observed, as a very general result, that when the pressure decreased at night, whilst the temperature increased, the succeeding weather was always disturbed and uncertain—in winter, gales of wind from the S.E. and S.W., with rain; whilst, on the contrary, a decreasing temperature, with an increasing pressure, was generally followed by fair weather, with winds varying from N.W. to N.E. The observations hitherto made with the dry and wet bulb thermometer had not yet been reduced. Of the ordinary thermometer, more than 50,000 hourly observations were now completed. Mr. Harris had received two very interesting communications on the Hourly Changes of Temperature, which enabled him to contrast the curves of Plymouth and Leith with those of Frankfort Arsenal, near Philadelphia, and three places in Ceylon. The Association was indebted to Major Ord, R.E., for the latter, and to Capt. Mordecai, of the United States' Corps of Ordnance, for the former. Hourly observations had been obtained by these gentlemen, similar to those which had already appeared in the Transactions of the Association, and which fully confirmed the results arrived at by Sir D. Brewster, to whom the scientific world is indebted for the first perfect series of hourly observations of the thermometer, and also the results of those arrived at by Mr. Harris in the discussion of similar observations carried on at Plymouth, at the request of the Association. Mr. Harris here exhibited, under the form of curves, the mean hourly progress of the temperature at these different places. It appeared, from these observations, that the line of mean temperature at the three stations in Ceylon, between 6° and 8° N. lat., was crossed between 9 and 10 A.M., and at 9 P.M. The mean temperature at these stations being 74° at Kandy, and from 80° to 81° of Fahrenheit at the others, which did not materially

differ from the times at Leith, in which the mean temperature is 48°, and the lat. about 55° N. At the Frankfort Arsenal, the line of mean temperature is crossed also about 10 A.M., but differed at night, being between 7 and 8 P.M.; whilst at Plymouth, the line of mean temperature was crossed soon after 8 A.M., and 7 A.M. by the latest observations. The little comparative mean range of the thermometer at Leith and Kandy, and in Ceylon, gave great similarity to the curves indicating the march of the hourly temperature in these places.---The author concluded with some general remarks on this subject.

Prof. Forbes and Prof. Whewell pointed out the necessity of reducing the observations to 32° of Fah.---Mr. Harris stated, that the temperatures at which the observations were made had not greatly differed, but that, before the Report appeared, the observations should be revised and reduced.

'On a New Calorimeter, by which the Heat disengaged in Combustion may be exactly measured, with some Introductory Remarks upon the Nature of different Coals,' by Andrew Ure, M.D.---In these researches, which are still in progress, the first point (said Dr. Ure) which I seek to ascertain is the proportion of volatile and fixed matter afforded by any kind of fuel---as, for example, pit-coal---when a given weight of it is subjected, in a retort or covered crucible, to a bright red heat. The result of this experiment shows how far the coal is a flaming or gas coal, and what quantity of coke it can produce. The second preliminary point of importance which I determine with regard to coals, is the amount of sulphur they may contain: a circumstance which has not hitherto been made the subject of precise investigation, in this country at least, but which is of great consequence, not only as to their domestic use, but to their employment by the iron-master and the manufacturer of gas. That good iron cannot be made with a sulphureous coal, however carefully coked, has been proved in France by a very costly experience. In general, when a coal leaves 15 or 16 per cent. of ferruginous ashes, we may conclude with certainty that it contains sulphur in corresponding proportion; for this substance exists always, I believe, in pit-coal, in the form of pyrites, but often disseminated or combined, so as to be invisible, unless by microscopic means. The most ready and exact method of determining rigidly the quantity of sulphur in any compound, is to mix a given weight of it with a certain weight of carbonate of potassa, nitre, and common salt, each chemically pure, and to ignite the mixture in a platinum crucible. A whitish mass is obtained, in which all the sulphur has been converted into sulphate of potassa. By ascertaining, with nitrate of baryta, the amount of sulphuric acid present, that of sulphur becomes known. By such a process, applied to different samples of coals, sent to me for analysis, I obtained the following results :---

Gas coals No. 1	Sulphur in 100 parts	3.00
2	....	3.90
3	....	2.42
4	....	3.86
5	....	2.50
6	....	5.20
7	....	3.40
8	....	3.50

Coals for puddling cast iron to be converted into steel.

1, hard foliated, or splent, sp. grav.	1.258	....	0.80
2, ditto	1.290	....	0.96
3, ditto	1.273	....	3.10
4, cubical, and rather soft........	1.267	....	0 80

The presence of much sulphur in a gas coal is a great evil, because it affords, in its decomposition, so much sulphuretted hydrogen, as requires an operose process of washing or purification, which impoverishes the gas, and impairs its illuminating power by the abstraction of its olefiant gas or carburetted hydrogen. Hence I found, in a specimen of coal gas, as generated in the retorts of one of the London gas companies, no less than 18 per cent. of olefiant gas; but in the same gas, after its purification from sulphur, I found only 11 per cent. With a coal, such as No. 4 of the second series given above, at least 10 per cent. of the light might be economized. The apparatus which I employ consists of a large copper bath, capable of holding 100 gallons of water: it is traversed, forwards and backwards, four times, in four different levels, by a zig-zag horizontal flue, or flat pipe, nine inches broad, and one inch deep, ending below in a round pipe, which passes through the bottom of the copper bath, and receives there into it the top of a small black lead furnace. The interior furnace, which contains the fuel, is surrounded, at the distance of an inch, by another furnace, which case serves to prevent the dissipation of heat into the atmosphere. A pipe, from a pair of double-cylinder bellows, enters the ash-pit of the furnace at one side, and supplies a steady current of air to keep up the combustion, kindled at first by half an ounce of red-hot charcoal. So completely is the heat which is disengaged by the burning fuel absorbed by the water in the bath, that the air discharged at the top orifice has usually the same temperature as the atmosphere. In the experiments made with former water *calorimeters* the combustion was maintained by the current of a chimney, open at bottom, which carried off at top a quantity of heat very difficult to estimate. My experiments have been directed hitherto chiefly to a comparison of the heating powers of Welsh anthracite, Llangennech, and a few other coals. I have found, that the anthracite, when burned in a peculiar way, with a certain small admixture of other coals, evolves a quantity of heat at least 35 per cent. greater than the Llangennech does, which latter is reckoned by many to be the best fuel for the purposes of steam navigation. One half pound of anthracite, burned with my apparatus, heats 600 pounds of water 10° Fahr., viz. from 62° to 72°, the temperature of the atmosphere being 66°; so that there is no fallacy

occasioned either by the conducting powers of the surrounding medium, or by a chimney current. We thus see that one pound of anthracite will communicate, to at least 12,000 times its weight of water, an elevation of temperature of 1°, by Fahrenheit's scale. For the sake of brevity, we may call this quantity, or energy, 12,000 unities of heat. One pound of Llangennech, in the same circumstances, will afford 9,000 unities: one pound of good charcoal, after ordinary exposure to the air, affords 10,500: perfectly anhydrous charcoal would yield much more: one pound of Lambton's Wall's-end coals affords 7,500 unities. It deserves to be remarked, that a coal, which produces in its ignition much carburetted hydrogen and water, does not afford so much heat as a coal equally rich in carbon, but of a less hydrogenated nature, because, towards the production of the carburetted hydrogen and water a great deal of latent or specific heat is required: indeed, the evaporation of unburnt volatile matter from ordinary flaming coals abstracts unprofitably a very large portion of their heat, which they would otherwise afford. Hence, those chemists who, with M. Berthier and Mr. Richardson, estimate the calorific powers of coals by the quantity of carbon which they contain, or the quantity of oxygen which they consume, have arrived at very erroneous conclusions. The amount of error may be detected by experiments on the cokes of flaming coals. M. Berthier examines coals for their proportion of carbon, by igniting a mixture of each, finely pulverized, with litharge, in a crucible, and estimates 1 part of carbon for every 34 parts of lead which is reduced. I have made many researches in this way with both charcoal and anthracite, and have obtained very discordant results. In one experiment, 10 grains of pulverized anthracite from Merthyr Tydfil, mixed with 500 grains of pure litharge, afforded 380 grains of metallic lead; in a second similar experiment, 10 grains of the very same anthracite afforded 450 grains of lead; in a third, 350 grains. In one experiment with good ordinary charcoal, fresh calcined, 10 grains, mixed with 1,000 of litharge, afforded no less than 603 grains of metal. The crucible was, in each case, covered and luted. My future researches, which are intended to embrace every important variety of fuel, natural and artificial, will be made with an apparatus somewhat modified from that here described. Three furnaces will be inclosed within each other, with a stratum of air or ground charcoal between each, so as to prevent all loss of heat into the atmosphere, and thereby to transfer the whole heat disengaged by combustion into a large body of water, of a temperature so much below that of the atmosphere at the beginning of the experiment, as it shall be above it at the conclusion.

'On a method of filling a Barometer without the aid of an Air-pump, and of obtaining an invariable level of the surface of the Mercury in the cistern,' by Prof. Stevelly.—Prof. Stevelly said that it was very difficult to fill a barometer tube so as to be quite free from air and moisture. Mr. Daniell, in his Meteorological Essays, proposed to fill the barometer

under the exhausted receiver of the air-pump, and actually had the barometer of the Royal Society so filled by Mr. Newman, under his own superintendence; but although an expert London working optician might be found capable of executing successfully such a tube, yet few in the country could hope for such an advantage; and, in fact, although he had attempted the process at Belfast, he had never succeeded. After some consideration, the following simple mode of using the torrecellian vacuum of the tube itself, instead of the air-pump, in filling it, occurred to him. He heated the mercury as hot as it could be used, and filled the tube, in the common way, to within half an inch of the top; then worked out, in the usual way, all air bubbles, as perfectly as possible; filled up the tube to the top, and inverted it in a cup of hot mercury, when it, of course, subsided, in the upper part of the tube to the barometric height; he then placed his finger on the mouth of the tube, under the mercury in the cup, and lifted it out; and, still holding his finger tightly over the mouth of the tube, laid it flat on a table, when the mercury in the tube soon lay at the under side of the tube, leaving the upper part along the length of the tube void. Upon then turning the tube slowly round, still keeping the finger on its mouth, every spark of air was gathered up. He then placed the tube in an upright position, with its mouth upwards, and, placing a funnel of clean dry paper about the upper part, an assistant filled the funnel slowly, with hot mercury, so as to cover the fingers. Upon slowly withdrawing the finger, the mercury went gently in, and displaced almost perfectly the atmospheric air which had gathered into the void space. By renewing the process which succeeded the previous washing of the air out of the tube, once, or at most twice, a column of the most perfect brilliancy was obtained. He had mentioned this simple method to Dr. Robinson, of Armagh, who suggested that, to get rid of the damp and greasiness of the finger, it would be better to cover the mouth during the process with clean and dry caoutchouc; and this was found a decided advantage. The method of procuring an invariable surface in the cistern was equally simple. From the imperfection of his sight, it was an object of much interest to him to have as few readings or adjustments depending on sight as possible. He proposed, therefore, to divided the cistern into two compartments, by a diaphragm of sheet iron or glass, brought to a sharp edge at top. Into one of these compartments, the barometer tube dips; in the other is placed a plunger of glass or cast iron, which can be raised or lowered by a slow screw movement. To prepare for an observation, the plunger is first screwed down, by which it displaces the mercury in one compartment, and raises its surface in the other above the edge of the diaphragm; upon raising it slowly again, the mercury drains off to the level of the edge of the diaphragm, thus, at every observation, reducing the surface to a fixed level.

SECTION B.---CHEMISTRY AND MINERALOGY.---Thursday.

'Notice of some Experiments upon a new Compound, called Iodosulphuric Acid, upon the true constitution of Chlorochromic Acid, and upon Chromamide,' by Mr. Lyon Playfair.---The object which I proposed to attain (said the writer) in commencing these experiments, was to discover some mode of isolating hyposulphurous acid. The experiments are still unfinished, but I will here notice the results already obtained. The best method of studying this subject appeared to be, to examine the characters of those compounds which have an analogous constitution. Chlorochromic acid, according to MM. Walter and Regnault, may be viewed as a compound of a hypothetical radical, "chromous acid," united with an atom of chlorine. If hyposulphurous acid also be considered as a combination of sulphurous acid with sulphur, both of these acids would belong to the same class. But as the opinions of chemists are much divided respecting the true rational composition of chlorochromic acid, Mr. Playfair was anxious to ascertain which view was the most correct. For this purpose, the behaviour of the solid compound of chlorochromic acid and ammonia was examined. By various tests applied to it, it did not appear to contain chromic acid. Now, if chlorochromic acid be really a salt, the bichromate of the perchloride of chromium, it ought to contain chromic acid; in short, it seems to be a peculiar compound, chromamide united with muriate of ammonia, and analogous to the sulphamide of Regnault. Chlorosulphuric acid is a compound which did not suit my purpose, on account of its never being obtained free from a foreign substance---the *liquor* of the Dutch chemists. It therefore became necessary to discover a substance of an analogous constitution, and which might be obtained with more ease, and with more purity. For this purpose, two equivalents of iodine were mixed with one of sulphite of lead, and the mixture was subjected to distillation: a dark red fluid passed over. This method, however, does not yield it of sufficient purity, being contaminated with iodine, which it retains in solution. A better method, therefore, consists in dissolving iodine in pyroxylic spirit, and sending a steam of sulphuric acid through the solution until it be completely saturated. By evaporation, distillation, and allowing the substance thus procured to remain over sulphuric acid, it may be obtained in a state of absolute purity; its taste is extremely acid, and when it is dropped upon the cuticle, a disagreeable obstinate sore is occasioned. I hoped that hyposulphurous acid might be isolated in a similiar manner, and, upon trying the experiment, with the substitution of sulphur for iodine, a yellow liquid of an acid taste, distilled over; but it speedily decomposed with the deposition of sulphur. A sufficient quantity was not obtained for analytical investigation. There are many other modes suggested by the properties of iodosulphuric acid, some of which I hope may succeed. I have merely stated the method of obtaining iodosulphuric acid, but the same process is applicable to

many others of a similiar class, whose properties I am at present investigating. The circumstances which led me to enter into these experiments, were to remove the objections which the opponents of isomorphism have urged against that theory, on account of the great dissimilarity, both in chemical and in physical characters, which exists between the chromates and their corresponding sulphates. By boiling a sulphate of the oxide required with chromate of barytes, soluble salts may be obtained, isomorphous with the sulphates, and, in general, affecting the same number of atoms of water. The insoluble chromates, generally described in systematic treaties on chemistry as neutral chromates, are of a very interesting constitution, but their analytical developement is extremely intricate, from the fact of there being several of each oxide. There are many other points connected with this subject, with which I cannot detain you.*

'A new theory of the Galvanization of Metals,' by Prof. Schonbein, of Basle.—The Professor began by stating, that the discovery of the chemical power of the voltaic pile, made in the beginning of the present century by British philosophers, drew the attention of the scientific world to the relations which exist between chemical and electrical phenomena; indeed, only a few years after this important fact had been ascertained, Sir Humphry Davy and Berzelius did not hesitate to establish the theory which has since been generally adopted---viz. that chemical and electrical forces are essentially the same. Prof. Schonbein considers, that the results of recent experiments are opposed to the theory. The facts which he brings forward in opposition to it are as follows:---1. A piece of iron was voltaically associated with a piece of zinc, and each of these metals was put into a separate vessel, filled with common water. The vessels did not communicate with each other. In the course of a few hours after the immersion of the iron, light flakes of oxide of iron made their appearance round the metal, and, after a couple of days, the latter was corroded to a considerable degree. The same result was obtained when the iron was plunged into water, and the zinc made to rise above the level of the fluid, so as to prevent the latter from being in the least contact with water. According to Prof. Schönbein, a piece of iron, when immersed in water without any voltaic association, was as much corroded as under the circumstances detailed. 2. Two pieces of iron were made, one of them the positive, the other the negative pole of a voltaic pile, which consisted of ten pairs of copper and zinc, and was charged with water holding 5 per cent. of common salt in solution. Each of the polar wires was put in a separate vessel, filled with common water. Under these circumstances, both wires were equally attacked and corroded in the same manner as if a single piece of

* The young chemist whose name is already associated with original researches came to Calcutta in 1838, but was induced to return by the same ship that brought him out. Europe undoubtedly presents a wider field to philosophical minds, but settle where he may, Mr. Playfair will rise to the first eminence in his profession.

iron had been put into water, for, after the lapse of a couple of hours, the polar wires were seen to be surrounded by light flakes of oxide of iron. 3. A piece of iron being voltaically associated with zinc, was exposed to the action of the atmosphere. Having left this voltaic pair for some time to itself, the iron part of it appeared to be covered with a thin layer of rust, and on comparing it with a piece of iron which had also been placed within the atmosphere during the same space of time, no evident difference could be detected between the states of the surfaces of both pieces. 4. A piece of iron wire was connected with each of the poles of a voltaic pile, without making the wires touch each other. Being exposed to the action of the atmosphere under these circumstances, both polar wires appeared, after some time, equally effected by rust, and as much as another piece of iron which was not connected with a pile. 5. A piece of iron, being voltaically associated with zinc, was placed in common water, so that both metals were deposited in the same vessel. Although this voltaic pair has been kept in water for twelve months, the iron part of it does not appear to be in the least degree oxidized, its surface being perfectly brilliant. 6. A piece of iron wire was connected with each of the poles of a pile, and each of these pieces made to plunge into a separate vessel filled with common water, the vessels being connected by means of a piece of platinum. That portion of the negative polar wire which was immersed in the water did not rust at all, as long as there was a current passing through the arrangement. 7. Copper being intimately associated with zinc, and brought into an aqueous solution of chloride of sodium (in such a manner that each of the metals was plunged into a separate vessel), was soon chemically affected,—provided that the vessels did not communicate with each other. 8. The same experiment was made as in the preceding case, with the difference, however, that both metals were plunged into the same vessel. Under these circumstances, the copper piece was not in the least corroded by the salt water, whatever the length of time was during which the metals were immersed. 9. A piece of copper was connected with each of the poles of a voltaic pile, and put into a vessel containing an aqueous solution of common salt. Both pieces were attacked by the fluid just in the same way as if they had not been attached to a voltaic arrangement, provided the vessels did not communicate with each other. 10. The experiment was made as in the preceding case, with the difference only, that the vessels were made to communicate with each other by means of a piece of platium. The positive polar wire quickly underwent oxidation, while the negative one remained untouched. If an aqueous solution of common salt was made use of as the exciting fluid in the pile, and the latter left unclosed, the copper pieces of the voltaic pair rather readily entered into oxidation, while they were not all chemically affected when the pile was closed. 11. A piece either of copper or of iron was connected with each of the poles of a pile; two tumblers were filled, partly with mercury, partly with water, or with a solution of common salt, and the

vessels made to communicate with each other by platinum, so as to make each extremity of the latter enter into the mercury of either vessel. Things having been arranged in the manner described, the polar wires were each introduced into one of the tumblers, so that the free end of each wire was made to plunge into the mercury. Under these circumstances, both polar wires appeared to be equally affected---that is, they were precisely in the circumstances as if they had not been connected with any voltaic arrangement. From these facts, Prof. Schönbein infers---1st, That neither common nor voltaic electricity is capable of changing the chemical bearings of any body, and that the principles of the electro-chemical theory, as laid down by Davy and Berzelius, are fallacious. 2nd, The change which certain metallic bodies, when placed under the influence of a current, seem to undergo with regard to their chemical relations, is due to the production of some substance or other, and its deposition upon those bodies by the agency of a current of electricity. 3rd, The condition, *sine qua non*, for efficaciously protecting readily-oxidizable metals against the action of free oxygen dissolved in fluids, is, to arrange a closed voltaic circle, which is made up, on one side, of the metal to be protected, and another metallic body more readily oxidizable than the former, and, on the other side, of an electrolyte containing hydrogen, as water.

Prof. Shepard, of the Medical College, South Carolina, gave an account of the analysis of a Meteorite, in which he had detected chlorine and silicon.

'On the Composition of Idocrase,' by Mr. T. Richardson.---The composition of the Silicates has attracted a considerable share of the attention of chemists, but until the discovery of the doctrine of Isomorphism, this department of mineralogy might be said to have remained stationary. It is however remarkable, that, even with the advantages of this beautiful law, many of the formulæ of minerals are very incorrect representations of their constitution, as, for example, in the received formula of Petalite, there is a difference of six per cent, of Silica between the result of the analysis and that computed; and this is only one among many instances which might be adduced. Idocrase is even in a worse state than this, for Berzelius says, (Die Anwendung Lothrohres, p. 218,) that the formula is not known with certainty, although Prof. Johnstone, in his report on Dimorphous Bodies, has assigned to it the following formula in common with the Garnet---viz.

$$\dot{\mathrm{Ca}}_3\,\dddot{\mathrm{Si}} + \left\{\begin{matrix}\underline{\dddot{\mathrm{Al}}}\\ \underline{\dddot{\mathrm{Fe}}}\end{matrix}\right.\ \dddot{\mathrm{Si}}$$

The subject has moreover been lately involved in greater obscurity, by the publication of M. Ivanoe's analysis in Poggendorff's Annalen, which differs from all the analyses hitherto made. With the view then of assisting in explaining these descrepancies, I have made the following analyses of Idocrase from different localities, with specimens selected

from the cabinet of Mr. Hutton, of Newcastle-on-Tyne. It is needless to give the detail of the analyses, which were made with every care:— No. 1. was a specimen of Idocrase from Egg, in Norway; 2. Idocrase from Slatoush, in Siberia; 3 Idocrase from Piedmont; 4. Vesuvian from Monte Somma: 5. Egerane from Eger, in Bohemia.

	1	2	3	4	5
Silica	38.75	37.45	39.25	37.90	38.40
Alumina	17.35	18.85	17.30	18.16	18.15
Protox. Iron	8 10	7.75	7.62	4.89	7.40
Protox. Manganese	,,	trace	3.50	,,	trace
Lime	33.60	35.25	32.25	34.69	33.09
Magnesia	1 50	1.35	.47	3.23	3.02
	99.30	100.35	100.30	98 86	100.06

The result of these analyses is, that the composition of Idocrase may be represented by the formula,

7 (FO, MO, CaO MgO)$_3$SiO$_3$ + 5 Al$_2$ O$_3$ SiO$_3$ which may also be referred back to the fundamental formula of the Garnet, 3 RO, SiO$_3$ + R$_2$ O$_3$ SiO$_3$. This result however, suggests the idea, that by attending more to the exact representation of the analytical results in the formula, some new light may possibly be thrown on some points in Isomorphism.

'Experiments on Fermentation,' with some general remarks, by Dr. Ure.*—A dispute having taken place between some distillers in Ireland, and officers of Excise, concerning the formation of alcohol in the vats or tuns by spontaneous fermentation, without the presence of yeasts, the Commissioners of Excise thought fit to cause a series of experiments to be made upon the subject, and they were placed under my general superintendence. An experiment was made on the 6th of October, 1837, with the following mixture of corn.

2 Bushels of Barley weighing	100lb	5 oz.
½ Bushel of Malt	21	7
½ Bushel of Oats	20	12
Total, 3 Bushels, weighing	142	8

The bruised corn was wetted with 26 gallons of water at the temperature of 160° F., and after proper stirring, had 8 gallons more of water added to it at the average temperature of 194°. The mash was again well stirred, and at the end of 45 minutes the whole was covered up, having at that time a temperature of 138° F. Three hours afterwards, 16 gallons of wash only were drawn off; being considerably less than should have been obtained, had the apparatus been constructed somewhat differently, as shall be presently pointed out. The gravity of that wash was 1,060; or in the language of the distiller, 60 degrees. After a delay of

* From the pressure of business before the Section, Dr. Ure did not read this paper, but gave merely a summary of its contents.

two hours more, twenty additional gallons of water at the temperature of 200° were introduced, when the mash was well stirred, and then covered up for two hours, at which period 23 gallons of fine worts, of specific gravity 1.242, were drawn off. An hour afterwards 12 gallons of water at 200° were added to the residual grains, and in an hour and a half 11 gallons of wort, of the density 1.033, were obtained. Next morning the several worts were collected in a new mash tun. They consisted of 48 gallons at the temperature 80°, and of a specific gravity 2.0465, when reduced to 60°. Being set at 80°, fermentation soon commenced; in two days the specific gravity had fallen to 1.0317; in three days to 1.018; in four days to 1.013; and in five days to 1.012; the temperature having at last fallen to 78° F. The total attenuation was therefore 34½ degrees, indicating the production of 3.31 gallons of proof spirit; while the produce by distillation in low wines was 3.22; and by rectification in spirits and feints it was 3.05. The next experiment was commenced on the 12th of October, upon a similar mixture of corn to the preceding. 48 gallons of worts of 1.043 specific gravity were set at 82° in the tun, which next day was attenuated to 1.0418; in two days to 1.0202; in three days to 1.0125; and in five days to 1.0105: constituting in the whole an attenuation of 32½ degrees, which indicates the production of 3.12 gallons of proof spirits; while the produce of the first distillation was 2.93 in low wines; and that of the second in feints and spirits was 2.66. In these experiments, the wash when fermenting most actively, seemed to simmer and boil on the surface, with the emission of a hissing noise, and the copious evolution of carbonic acid gas. They prove beyond all doubt, that much alcohol may be generated in grain worts, without the addition of yeast, and that also at an early period; but the fermentation is never so active as with yeast, nor does it continue so long, or proceed to nearly the same degree of attenuation. I was never satisfied with the construction of the mash tun used in these experiments, and had accordingly suggested another form, by which the mash mixture could be maintained at the proper temperature during the mashing period. It is known to chemists, that the diastase of malt is the true saccharifying ferment which converts the fecula or starch of barley and other corn into sugar; but it acts beneficially only between the temperatures of 145° and 168° F.* When the temperature falls below the former number saccharification languishes, and when it rises much above the latter it is entirely checked. The new mash tun was made of sheet zinc, somewhat wider at bottom than top; it was placed in a wooded tun, so much larger, as to leave an interstitial space between the two of a couple of inches at the sides and bottom. Through this space a current of water at 160° was made to circulate slowly during the mashing period. Three bushels

* M. Raspail's observations upon diastase are entirely erroneous; and cannot be allowed to invalidate the facts adduced by Payen, Persoz, and Guerin Varry. In fact, were Raspail correct, wheat flour boiled with water should immediately form sugar.

of malt, weighing 125 lb. 3 oz., were wetted with 30 gallons of water at 167°, and the mixture being well agitated, the mash was left covered up at a temperature of 140° during three hours, when 19 gallons of fine worts were drawn off at the specific gravity of 1.0902, or 90.2 degrees. Twenty gallons more water at 167° were then added to the residuum, which afforded after two hours 28 gallons of wort at the gravity of 1.036; 12 gallons of water at 167° were now poured on, which yielded after other two hours 15 gallons at the gravity 1.0185. Forty gallons of fine worts at 1.058 gravity, and 68° temperature, were collected in the evening of the same day, and let into the tun with 5 per cent. of yeast. The attenuation amounted in six days to 54 degrees. The third wort of this brewing, amounting to 15 gallons, being very feeble, was mixed with 7 gallons of the first and second worts, put into a copper, and concentrated by boiling to 11 gallons, which had a gravity of 1.058 at 60° F. They were separately fermented with five per cent. of yeast, and suffered an attenuation of 48½ degrees. The produce of spirit from both, indicated by the attenuation was 5.36 gallons; the produce in low wines was actually 5.52, and that in spirits and feints was 5.33, being a perfect accordance with the Excise tables.

The next experiments were made with a view of determining at what elevation of temperature the activity or efficiency of yeast would be paralyzed, and how far the attenuation of worts could be pushed within six hours, which is the time limited by law for worts to be collected into the tun, from the time of beginning to run from the coolers. When worts of the gravity 1.0898 were set at 96° Fahr., with 5 per cent. of yeast, they attenuated 26.9° in six hours; worts of 1.0535 gravity set at 110° with 5 per cent. of yeast, attenuated 16° in about 5 hours; but when worts of 1.0533 were set, as above, at 120°, they neither fermented then, nor when allowed to cool; showing that the activity of the yeast was destroyed. When fresh yeast was now added to the last portion of worts, the attenuation became 5.8° in 2 hours, and 28.4° in 3 days; showing that the saccharine matter of the worts still retained its fermentative faculty. Malt worts being brewed as above specified, were set in the tun, one portion at a temperature of 70°, with a gravity of 1.0939, and 5 per cent. of yeast, which attenuated 66° in 3 days; other two portions of the same gravity were set at 120°, with about 10 per cent. of yeast, which underwent no fermentative change or attenuation in 6 hours, all the yeast having fallen to the bottom of the tuns. When these two samples of worts were allowed, however, to cool to from 74° to 72°, fermentation commenced, and produced in two days an attenuation of about 79°. It would appear, from these last two experiments, that yeast to the amount of 5 per cent. is so powerfully affected by strong worts heated to 120°, as to have its fermentative energy destroyed; but that when yeast is added to the amount of 10 per cent., the 5 parts of excess are not permanently decomposed, but have their activity merely suspended till the saccharine liquid falls to a temperature compatible

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with fermentation. Yeast, according to my observations, when viewed in a good achromatic microscope, consists altogether of translucent, spherical and spheroidal particles, each of about the 6000th part of an inch in diameter. When the beer in which they float is washed away with a little water, they are seen to be colourless; their yellowish tint, when they are examined directly from the fermenting square or round of a porter brewery, being due to the infusion of the brown malt. The yeast of a square newly set seems to consist of particles smaller than those of older yeast, but the difference of size is not considerable. The researches of Shulze, Cagniard de la Tour, and Schwann, appear to show that the vinous fermentation, and the putrefaction of animal matters—processes which have been hitherto considered as belonging entirely to the domain of chemical affinity—are essentially the results of an organic development of living beings. This position seems to be established by the following experiments:—1. A matrass or flask containing a few bits of flesh being filled up to one-third of its capacity with water, was closed with a cork, into which two slender glass tubes were cemented air-tight. Both of these tubes were passed externally through a metallic bath, kept constantly melted, at a temperature approaching to that of boiling mercury. The end of one of the tubes, on emerging from the bath, was placed in communication with a gasometer. The contents of the matrass were now made to boil briskly, so that the air contained in it and the glass tubes was expelled. The matrass being then allowed to cool, a current of atmospherical air was made constantly to pass through it from the gasometer, while the metallic bath was kept constantly hot enough to decompose the living particles in the air. In these experiments, which were many times repeated, no infusoria or fungi appeared, no putrefaction took place, the flesh underwent no change, and the liquor remained as clear as it was immediately after being boiled. As it was found very troublesome to maintain the metallic bath at the melting pitch, the following modification of the apparatus was adopted in the subsequent researches. A flask of three ounces capacity, being one-fourth filled with water and flesh, was closed with a tight cork, secured in its place by wire. Two glass tubes were passed through the cork; the one of them was bent down, and dipped at its end into a small capsule containing quicksilver, covered with a layer of oil; the other was bent on leaving the cork, first into a horizontal direction, and downwards for an inch and a half, afterwards into a pair of spiral turns, then upwards, lastly horizontal, whence it was drawn out to a point. The pores of the cork having been filled with caoutchouc varnish, the contents of the flask were boiled till steam issued copiously through both of the glass tubes, and the quicksilver and oil became as hot as boiling water. In order that no living particles could be generated in the water condensed beneath the oil, a few fragments of corrosive sublimate were laid upon the quicksilver. During the boiling, the flame of a spirit lamp was drawn up over the spiral part of the second glass tube, by means of a

glass chimney placed over it, so as to soften the glass, while the further part of the tube was heated by another spirit lamp, to prevent its getting cracked by the condensation of the steam. After the ebullition had been kept up a quarter of an hour, the flask was allowed to cool and get filled with air through the hot spiral of the second tube. When the contents were quite cold, the end of this tube was hermetically sealed, the part of it between the point and the spiral was heated strongly with the flames, and the lamps were then withdrawn. The matrass contained now nothing but boiled flesh and gently ignited air. The air was renewed occasionally through the second tube, its spiral part being first strongly heated, its point then broken off, and connected with a gasometer, which caused the air to pass onwards slowly, and escape at the end of the first tube immersed in the quicksilver. The end of the second tube was again hermetically closed, while the part interjacent between it and the spiral was exposed to the spirit flame. By means of these precautions, decoctions of flesh were preserved, during a period of six weeks, in a temperature of from 14° to 20° R. (63½° to 77° F.), without any appearance of putrefaction, infusoria, or mouldiness: on opening the vessel, however, the contents fermented in a few days, as if they had been boiled in the ordinary manner. In conducting such researches, the greatest pains must be taken to render the cork and junctions of the glass tubes perfectly air-tight. The following more convenient modification of the experiment, but one equally successful and demonstrative, was arranged by F. Schulze. The glass tubes connected with the flask, were furnished each with a bulb at a little distance from the cork; into one of which globes caustic alkaline lye being put, and into the other strong sulphuric acid, air was slowly sucked through the extremity of the one tube, while it entered at the other, so as to renew the atmosphere over the decoction of flesh in the flask. In another set of experiments, four flasks being filled with a solution of cane-sugar, containing some beer yeast, were corked, and plunged in boiling water till they acquired its temperature. They were then taken out, inverted in a mercurial bath, uncorked, and allowed to cool in that position. From one-third to one-fourth of their volume of atmospherical air was now introduced into each of the flasks; into two of them, through slender glass tubes kept red hot at a certain point, into the other two through glass tubes not heated. By analysis it was found that the air thus heated contained only 19.4 per cent. of oxygen, instead of 20.8; but, to compensate for this deficiency, a little more air was admitted into the two flasks connected with the heated tubes, than into the two others. The flasks were now corked and placed in an inverted position, in a temperature of from 10° to 14° R. (54½° to 63½° F.) After a period of from four to six weeks, it was found that fermentation had taken place in both of the flasks which contained the non-ignited air—for, in loosening the corks, some of the contents were projected with force—but, in the other two flasks, there was no appear-

ance of fermentation, either then, or in double the time. As the extract of nux vomica is known to be a poison to *infusoria* (animalcules), but not to vegetating mould, while arsenic is a poison to both, by these tests it was proved that the living particles instrumental to fermentation belonged to the order of plants of the Confervoid family. Beer yeast, according to Schwann, consists entirely of microscopic fungi, in the shape of small oval grains of a yellowish white colour, arranged in rows oblique to each other. Fresh grape must contains none of them; but, after being exposed to the air at 20° R., for 36 hours, similar grains become visible in the microscope, and may be observed to grow larger in the course of an hour, or even in half that time. A few hours after these plants are first perceived, gas begins to be disengaged. They multiply greatly in the course of fermentation, and at its conclusion subside to the bottom of the beer in the shape of a yellow white powder.

Mr. Martineau objected to the low temperatures for making extracts mentioned by Dr. Ure.---Mr. Black, on being referred to by Dr. Ure, stated that the temperatures used by distillers and brewers were very different, in consequence of the difference of the materials used in brewing distillers' wash and brewers' wort. The distillers use sometimes only one-tenth part of malt, and the remainder bruised barley, or other corn; and were they to use such high temperatures, in the first mashing, as those used by brewers who use only malt, the mass would get coagulated like thin batter,---or the tun set, as it is technically termed. The distillers, however, after making their first infusion at much lower temperatures than brewers, bring them up, before running off the worts, by the addition of water, at as high a temperature as any used by the brewer. Mr. Black seemed also to object to so high a temperature as Mr. Martineau mentioned for the first infusion, 180° F., but preferred 10° or 12° lower, the heat being afterwards brought up in the same way as in the distillery.

Section C.---Geology and Geography.---Thursday.

Mr. Bowman read a paper on some skeletons of fossil vegetables, found by Mr. Binney, in the shape of a white impalpable powder, under a peat bog near Gainsborough, occupying a stratum four to six inches in thickness, and covering an area of several acres. It remained unchanged by the sulphuric, hydrochloric, and nitric acids, and by heat, and was concluded to be pure silica, in a state of extremely minute subdivision. On submitting it to the highest power of the compound microscope, it was found to consist of a mass of transparent squares and parallelograms of different relative proportions, whose edges were perfectly sharp and smooth, and the areas often traced with very delicate parallel lines. On comparing these with the forms of some existing Confervæ, Mr. Bowman found the resemblance so strong, that he entertained no doubt they were the fragments of parasitical plants of that order, either identi-

cal with or nearly allied to, the tribe Diatomaceæ, which grow abundantly on other Algæ, both marine and fresh-water, but are so minute, that individually they are invisible to the naked eye. To enable the Section to judge for themselves, Mr. Bowman exhibited highly-magnified drawings of some of these, from the works of Dr. Greville, and also of the powder, which showed the resemblance to be complete. They are, therefore, the counterparts of the fossil Infusoria of Ehrenberg, and occupy the same place in the Vegetable kingdom as those do in the Animal.

The President observed, that, as far as he was aware, the discovery was quite new to science. He instanced, that some minute floating Confervæ had been found on the Lake of Neuchatel; and Mr. Bowman said he had observed something similar in the lakes near Ellesmere, which annually took place, and rendered it probable that a like deposition of their remains was now going on.

Sir Charles Lemon reported, that an interview had taken place between the Government and the Committee appointed at the Newcastle meeting for taking steps towards the preservation of mining records; and Mr. De la Beche mentioned, that a person had already been appoint-for the purpose, and would enter on the duties of his office next year.

Mr. Murchison then exhibited a Geological Map of Europe, coloured by Von Dechen, and the first part of a work on Petrifactions, collected by M. von Humboldt, in South America. This latter work has led to some important conclusions---no oolitic or jurassic strata seem to exist in South America, or perhaps even in North America; but there is a large development of the tertiary series, and a still larger of certaceous in the southern continent. Specimens of Silurian fossils have been brought to the present meeting of the Association, collected in North America, by Prof. Shepard, of Newhaven.

In reference to the map of Europe, Mr. Greenough gave it as a highly probable opinion, that under the morasses of Northern Germany a valuable coal-field may exist.

Mr. Murchison then called the attention of the meeting to a section of part of Germany which he had lately visited. Mr. Murchison stated, that having, with Prof. Sedgwick, examined the older rocks of Western Germany and Belgium, it is their intention to lay before the Geological Society of London a memoir, illustrated by fossils, on the classification of those ancient deposits, a succession of the Carboniferous, Devonian, and Silurian systems. His present communication bore only on one point of this analysis, offering to prove the geological position of the anthracite or culm-bearing strata of Devonshire and Cornwall. Transverse sections, in descending order, from the productive coal-field of Westphalia on the N.N.E., to the uppermost division of protozoic rocks on the S.S.W., were explained; and one from Dortmund, by Schelke, to the neighbourhood of Limburg and Iserlohn, was specially adduced, in which the various masses of strata are clearly exposed, viz.

1. Coal shales, coal, &c.—a productive coal-field. 2. Millstone grit series, with many impressions of small plants, and occasional thin seams of coal. 3. Thinly laminated carbonaceous sandstones and shales, containing many plants, together with bands of flat bedded, black, bituminous limestone and shale, charged with Posidonia and Goniatites, and alternating with courses of "Kiesel schiefer," or, flinty slate. 4. Carboniferous limestone, of great thickness, like the British, and loaded with many well-known fossils. 5. Devonshire rocks, black schists, grey and red sandstones, with occasional calcareous courses, and numerous fossils, the old graywacke of the Germans. The order and sequence of these strata are indicated and maintained along the lower edge of the whole range of the Westphalian coal-field, the beds necessarily rising to the surface at angles of 30° to 40°, in perfect conformity, and showing throughout the clearest and most complete transition into each other. It was particularly to the group No. 3, that Mr. Murchison directed attention, being quite identical with the culm-bearing strata of North Devon and Cornwall, first described by him and Prof. Sedgwick as a portion of a true coal-field, and as not belonging to the graywacke, or older transition rocks—(see *Athen.* No. 461.) The Westphalian sections establish the geological position of the Biddeford culm strata more clearly than any stratigraphical evidence in Great Britain, by presenting five masses of unequivocal mountain limestone, rising from beneath the black limestone and culmiferous schists, and thus the precise age of the latter is demonstrated. In regard to the rocks of the Devonian system, or old graywacke, which support in mountain masses the carboniferous system above alluded to, Mr. Murchison offered a brief and general sketch, promising, that in the ensuing session of the Geological Society Mr. Sedgwick and he will show that these rocks fairly represent the British old red sandstone, or Devonian system. This latter term foreign geologists do not seem disposed to adopt, although it might save much confusion, it being now ascertained that black and slaty rocks occupy, in very extended districts, the same geological position as the red rocks of Herefordshire. Proofs of the existence of the same order and succession will be hereafter pointed out in the countries of the Hartz and the Fichtelgebirge, as well as upon both sides of the Rhine, while a splendid development of the still older Silurian rocks, both upper and lower, will be pointed out, chiefly on the left bank of the Rhine, also in Belgium, at Liege, and Namur.

Mr. Greenough was inclined now to coincide with Mr. Murchison in opinion as to the age of the culm-bearing strata of Devonshire.—Mr. De la Beche said he was open to conviction on perfect evidence, and that the proofs brought forward from Germany had been the best as yet afforded by Mr. Murchison.—Mr. Williams could not give in his adhesion; and Dr. Buckland was glad that one opponent still remained to the new theory.—Mr. Lyell referred to Mr. Lonsdale, who had been the main instrument in determining the age of the Devonian rocks. By

an inspection of the fossils, he had predicted that those rocks, although different in mineral composition, would agree in age with the old red sandstone, being between the Carboniferous and Silurian systems.

Dr. Buckland announced, that the fossil Flora of Great Britain was about to be continued by Messrs. Hutton and Henslow, who solicited the loan of specimens, which might be sent to the Geological Society, and would be carefully returned, after drawings had been made from them.

Dr. Lloyd made some observations on the Geology of Warwickshire, and announced the discovery of Saurian remains in that country. He first alluded to the coal-field of North Warwickshire, between Tamworth and Coventry, in which the axis of direction has been ascertained to be N.N.W. to S.S.E. Near Nuneaton, is a quartzy rock, similar to that of Charnwood Forest, being, in all probability, an altered Caradoc sandstone; it contains manganese, and is without any organic remains; some volcanic rocks occur. Greenstone is found at Griff Hollow and at Marston Japet, showing that the district has, at one time, been disturbed; indeed, Prof. Sedgwick considers that this coal-field has been elevated during the deposition of the lower member of the new red sandstone. Between Birmingham and Warwick may be seen some outliers of lias, as at Knowle and Chesterton. At Warwick, a different sandstone from the others may be observed; and at Stockingford, coal, with a limestone underlying---black, smoky, and containing plants---also, occasionally, galena. In this district, there is no magnesian limestone. In the *bunter sandstein* of Allesley, near Coventry, the remains of a coniferous fossil tree have been discovered, and in the same formation a jaw bone, but it is uncertain whether belonging to a fish or a saurian. At Garrison Hill there occurs a highly calcareous rock, but it is uncertain if it can be regarded as muschelkalk: and the absence of this rock renders the division of the Warwickshire sandstone imperfect. There is a difficulty in what class to place the sandstone at Warwick, which resembles bunter sandstein, but it contains the salt springs of Leamington, and which springs are generally confined to the keuper, or upper formation. Perhaps there may be a fault in this locality, by which the sandstone has been elevated, but there seems to be no disturbance of the adjacent strata. The organic remains found in this sandstone have been regarded as belonging to the Dolichognathus, Platygnathus, and Megalosaurus—with them coprolites are found. At Shrewley Common, the sandstone is evidently keuper, containing Posidonia minuta; it bears impressions of animals; also ripple marks and worm marks. In the rag bed of the Warwick sandstone, organic remains have been found; it contains some carbonate of lime. At Warwick a little rock salt has also been found.

Mr. Strickland regarded the sandstone at Warwick as bunter sandstein, that had been elevated by a fault. At Droitwich a similar sandstone is overlaid by the salt marle.---Dr. Buckland said, that a like rock is found on the top of the variegated marle.

Dr. Ward exhibited specimens and drawings illustrative of impressions of the feet of animals on the Greensill sandstone, near Shrewsbury. Greensill Hill consists of a steep escarpment of new red sandstone, and contains four strata that have been described by Mr. Murchison, and in the second of which the impressions were found. This stratum, when exposed to the atmosphere, always splits so as to exhibit ripple marks, and on these marks the impressions of feet have been observed, as well as marks of drops of rain. These last are often in an oblique direction, as if having fallen in a gale of wind, the direction of which is thus pointed out. The foot marks differ from those of the Cheirotherium, in having only three toes, armed with long nails, directed forwards, and not spread out. Nothing resembling the ball of the foot has been observed, except in a few, which have some resemblance to the impression of the foot of a dog.

Dr. Buckland exhibited impressions in sandstone from Dumfriesshire.

Mr. Knipe read a communication on a Trap Dyke in Cumberland. It commences on the east side of the river Petterell, about six miles south of Carlisle, and about two from the limestone quarry at Broadfield; its composition is like onion basalt, decomposing in concentric layers. It passes by Great Barrock Hill and Armathwaite, crossing the River Eden; then by Combe's Peak and Stony Croft, Cringle Dyke, and Renwick, about two miles from which last place a good vertical section of it may be seen, on the west side of the Raven Water, which it crosses. It is met with at Hastside Fell, cutting through the Pennine chain, its eastern termination being about the source of the South Tyne River, near which it appears to have altered the adjoining strata. Its length is twenty-two miles, and its width from twenty to thirty yards. Its course coincides with that of the great Cleveland Dyke, and it is not improbable that they may be connected; if so, a basaltic dyke, 120 miles, long, crosses our island from the Solway Firth to the German Ocean.

A paper, 'On the Structure of Fossil Teeth,' by Mr. Nasmyth, was then read, illustrated by several drawings. It had been stated by some anatomists, that the proper dental substance consists of an uniform structureless substance, and of fibres passing through it; but the author was led to believe that this structureless substance is organized, and differently and characteristically in different animals, so as to be a means of classification. He employed a magnifying power of the tenth of an inch focal distance, with an achromatic condenser, and first found, in the tooth of a fossil rhinoceros, the appearance of cells or compartments, and afterwards found it to exist in recent teeth. He also examined the fibres of different teeth, and found that generally they presented an interrupted or baccated appearance,as if made up of different compartments, each class of animals presenting a different arrangement.

In a paper read before the Medical Section, Mr. Nasmyth treated more fully of the organization of the dental inter-fibrous substance, and entered also into some details on the structure of the pulp.

Mr. Darwin announced, that a work on fossil teeth, by Prof. Owen, would shortly be published.

A communication on Peat Bogs, by Dr. G. H. Adams, was then brought before the meeting. The author had examined microscopically many specimens of peat, and had found them to consist of bundles of little capsules, somewhat similar to bunches of raisins, attached to the radicals of the plants growing on the surface of the bogs. These, he thinks, have never been observed before, owing to old black portions of bog having been examined. He considers that fallen trees have no connexion with the formation of peat, except as furnishing carbonic acid gas from their decay. He attributes great importance to the well-known power of plants in separating carbonic acid from the atmosphere, and conceives that the preservative power of peat is owing to tannin, which substance may have escaped detection, from its being united to iron, so abundant in heaths, accounting thus for the dark colour of the lower parts of peat formations. The author considers, that the absence of peat in America is owing to the non-existence there of the family of Ericæ. He remarks, also, that peat does not serve as a manure, from its little tendency to decomposition; and he proposes to assist the decomposition by means of sulphuric acid---thus rendering available for agriculture large tracts of bog land now lying useless, especially in Ireland. He compares the analysis of Apotheme, the chief constituent of vegetable mould, with that of gallic acid, and thinks that the action of sulphuric acid on the latter, as contained in peat, would probably produce the former, which is the chief support of vegetation. If putrifying vegetable matter be mixed with peat, its unpleasant odour at once ceases. The author urges the importance of destroying this preservative power of peat, so that it may be converted into a manure---first, by destroying the plants, next by burning or paring the surface, then adding dilute sulphuric acid to it, collected into heaps.

Mr. J. B. Yates read a paper 'On the changes and improvements in the Embouchure of the Mersey.'---He referred to the new channel in the harbour of Liverpool, which had been brought before the notice of the Association by Capt. Denham. The intricacy of access to this harbour arises from the accumulation outside of numerous beds of sand, which are frequently and suddenly changing their position and elevation. It can scarcely be doubted, that at some remote period the estuary of the Mersey did not exist at all, or, at most, in a very limited form; a forest and morass may have occupied the land between Formby Point and Helbre. Numerous trunks and roots of large forest trees are, to this day, found along the Cheshire and Lancashire shores, while extensive tracts of peat are observed in many places starting up among the sands. A violent disruption must have taken place at the mouth of the estuary, by which enormous masses of sand and marle have been thrown out, perhaps proved by the homogeneous structure of the banks on either side. In 1828, a number of human skeletons were disinterred opposite

the Leasow Lighthouse, affording strong evidence that a burying-ground had formerly existed there, and a similar cemetery is discernible at Formby. This lighthouse stands in place of another, which was nearer to the sea by more than half a mile—a site which, at the time of its erection, seemed to have been firm, dry land, but was rendered useless by the encroachments of the water, which continued to increase. It was not until the sea had broken down the ridge of sand which had formed its boundary, that a strong embankment was made, extending a mile and a quarter in front of the present lighthouse. The sand banks in this estuary are tossed to and fro by the force of the winds and tides, and are constantly changing their shapes and elevations, and, having no escape, they remain pent up in the bay. In 1687, an excellent channel existed opposite to Formby Point, its depth from three to ten fathoms; but, not being marked by buoys, the Rock Channel was at that time the entrance in common use, though dry at low water. It has since become deeper, and thus a change has taken place upon the Hyle Sand Bank. A ridge, running along the middle of this bank, has been cut through by a channel having forced itself in a northerly direction, from Helbre island towards the Light Ship. The channel described by Capt. Denham at the Dublin Meeting is now useless, although used for some time with advantage; but it runs perpendicular to the course of the tide, which accounts for its present state. Fears have also been entertained, that the other channel, called the Horse Channel, was filling up. Lately, a diagonal channel has been formed, by aiding the ebb current of the tide in its natural diagonal course, between Lancashire and Cheshire. This was done by dredging, by means of a double-toothed harrow, twelve feet across, dragged backwards and forwards by a steamer of 100 horse-power over the intruding banks, the inner part of which was stated to rise forty-three feet higher than the outer or seaward part. An enormous wooden scraper is also used. The matter taken up appears to contain a small portion of peat, and weighs somewhat lighter than the sand found within the estuary. This new channel has been proved to answer the purposes of navigation beyond original expectation, and the approach to Liverpool is even better than before.

Mr. De la Beche mentioned, that submerged peat is found along many of the shores of Europe, being evidently the remains of forests that had sunk. These have been covered with sand, and now there are encroachments made upon the coasts near them, thus showing two sorts of changes of level. He was averse to any great encroachments being made on the shores of estuaries, as the natural process of scouring by means of the reflux of the tide was diminished.

SECTION D.—ZOOLOGY AND BOTANY.—Thursday.

Dr. Pritchard read a paper on 'The Extinction of the Human Races.' He expressed his regret that so little attention was given to Ethnography, or the natural history of the human race, while the opportunities for observation are every day passing away; and concluded by an appeal in favour of the Aborigines' Protection Society. The paper gave rise to a long and desultory conversation, in which Dr. Hodgkin, Mr. Wilde, Mr. Watson, Mr. Hall, Dr. Daubeny, Dr. Wilson (of America), Mr. Thompson, and others, took part.

A Report on the Disbribution of the Pulmoniferous Mollusca in Britain, and the Causes influencing it; drawn up at the request of the Association, by Mr. E. Forbes.—The object of this inquiry was to ascertain the geographical and geological distribution of pulmoniferous mollusca in the British isles. The subject was considered under three heads: first, a view of the various influences which affect their distribution; second, a detailed view of the distribution of the indigenous species in the various provinces of Britain; and third, the relations of that division of the native Fauna to the Fauna of Europe, and the distribution generally of the more remarkable species. Under the first head, after enumerating the various species of pulmoniferous mollusca inhabiting Britain, Mr. Forbes proceeded to review the causes influencing their distribution, dividing such causes into primary and secondary. Under the head of primary causes, he considered the two influences of climate and soil. The influence of climate in Britain is indicated by the reduced number of species found in the more northern or colder districts, as compared with the number inhabiting the provinces of the south and centre. It is also indicated by the disappearance of species which inhabit soils indifferently, as we advance northwards, and by the presence of species in certain situations in southern and warm districts, which usually avoid, or are sparingly found in such localities. It is further shown by the tendency of individuals to multiply in temperate situations, and by the superior beauty of colouring displayed by species inhabiting warm districts. The author then pointed out, that there existed in many places a stronger influence than climate, and showed that this influence was in its nature geological. He showed that various kinds of rocks influence the distribution of mollusca; that calcareous rocks are especially favourable to their distribution; and that all rocks containing much lime tend to increase both the number of species and of individuals living on them. Certain species are confined altogether to certain rocks, others to a class of rocks; and instances of the occurrence of such phenomena in Britain were enumerated. Some rocks influence the distribution *negatively*, diminishing the number both of species and individuals. The order of influence of rocks on species in Britain, is as follows, commencing with the most influential:—

1. Cretaceous and oolitic.
2. Carboniferous rocks and trap.

3. Tertiary.
4. Saliferous.
5. Slates.
6. Granite and Gneiss

Mr. Forbes noticed, that in certain cases climate neutralized the influence of the rock, and *vice versâ;* and instanced Guernsey, as a locality where the neutralization of geological influence by climate is *positive*, and Shetland, where it is *negative*. Under the head of secondary influences, Mr. Forbes considered the effect of the neighbourhood of the sea---the neighbourhood and elevation of mountains---the presence of woods, and the influence of the various trees found in them---the influence of water, especially of artificial water, as canals, and the vitiation of the Fauna by the agency of man, as in the case of the transportation of species by ballast, &c. Instances were given of the effect of these various influences in Britain, and the comparative effect of each on the existing Fauna considered. It was stated, that, in our country, the influence of elevation is always negative, but that in many other countries it is positive. It was shown also, that fossils, especially those of the newer pliocene strata, materially influence the Fauna in certain localities. A detailed view of the distribution of the species was then entered into. They were arranged under ten districts, viz. 1. the Channel Isles; 2. S. E. of England; 3. S. W. of England; 4. N. E. of England; 5 N. W. of England; 6. S. of Ireland; 7. W. of Ireland; 8. S. of Scotland; 9. W. of Scotland; 10. Shetland Isles. Tables were shown, exhibiting the relative importance of the various influences in each, and the causes of the presence of the more local species were considered. *Helix revoluta* and *Helix naticoides* were mentioned as additions to the British Fauna from Guernsey. The researches of Mr. Alder, of Newcastle, and Mr. Bean, of Scarborough, were particularly alluded to, and much novel information contributed by those gentlemen mentioned. Mr. Forbes then considered the distribution of the principal British species in foreign countries; and in a table exhibited a comparison between the principal published lists of Europe. The southern countries present much fuller lists than the northern. In the number of native species of helix, England exceeds Scandinavia by seventeen species, and Brabant by fifteen, but yields to the other European lists of equal importance, especially those of the southern countries of Europe. France exceeds Britain by no less than forty-one species. The *Helix fusca*, the *Clausilia Rolphii*, the *Pupa anglica*, and the *Lymnæa involuta*, of Thomson, were mentioned, as species, only found in Britain. Many remarkable instances of extensive distribution were mentioned. The common snail, *Helix aspersa*, is equally common throughout southern Europe, and is found also in parts of Asia, Africa, and North and South America; and the edible snail is nearly as widely distributed. The *Succinea amphibia* is very widely spread over the world, being found throughout Europe, from Archangel downwards, in North America, and in North and South Africa, as far as the Cape of

Good Hope, and the *Succinea oblonga* has also a very wide range. The consideration of the distribution of native species in foreign countries, was pressed as an important part of the examination, since, without such consideration, many fallacies may arise in drawing our conclusions.

Mr. Lyell observed, there were several points in relation to the distribution of recent animals that geologists required to know. In the first place, the influence of various kinds of rocks on the distribution of species. Strata in various stages of their growth contained various species. What were the laws which regulated this distribution with existing species? The mere chemical influence of strata is important. Freshwater shells exist without marine, and *vice versâ;* and it was desirable to know what was the influence of rocks in their neighbourhood upon them. It was desirable to know the chemical composition of rocks, as in many instances this must have great influence. Mollusca, for instance, formed their shells from lime, which they must have taken up as food. Again, a knowledge of the distribution of subaqueous species became important; and the sediments in the beds of rivers, and places where they are found, should be carefully observed and recorded; also the depth of the waters in which they are found, and the fuci or other plants which may grow in their neighbourhood. Shells are the most frequent organic remains, and therefore the most important. Mammalia, fishes, and reptiles are frequently absent in strata, but shells never. One of the great difficulties in studying these shells, was a want of knowledge of those which existed. As we passed through each stratum, the shells of each resembled more and more those of the strata above it, the nearer they were to it. Now the question presented itself in some of the upper strata, as to whether conchologists might not have overlooked existing species, and thus animals be thought extinct which are not so. Mr. Bean, of Scarborough, had lately found a shell that was supposed to be extinct. Another point of importance is the relation of shells to each other in a given district, such as the relation of the shells in rocks to those found in the sea near them. He had lately proposed the question to Messrs. Gray and Sowerby, as to whether there was any means of determining the relation between the number of the species of shells in the Mediterranean and the seas of the north of France. They told him there was no satisfactory means of doing so. They differed in their estimate, and the amount of information was of little value.

Mr. J. E. Bowman exhibited specimens of a species of Dodder (*Cuscuta epilinum*), first found in Britain, two years ago, by himself; and again in a new locality, within the present month. He believes it is to be found exclusively upon flax, and has been overlooked for *C. Europæa*, from which, however, it is quite distinct in its pedunculated heads, globular tube of the corolla, and the insertion of the stamens above the tips of the scales, which are geminate or bifid, with the lobes divaricate or fimbriated. As he observed these scales to differ a good deal from

each other, even in the same corolla, he cautions botanists against trusting too much to them as a specific character, with further observations. Still less does this agree with the continental *C. epilinum* of Weihe, which is described as "simplex, glomerulis ebracteatis, sub 5-floris;" because the new plant is sometimes branched, has its heads always subtended by a broad bractea, and each head, when luxuriant, consisting of eight, ten, or twelve flowers. Still, as the specific name is so strikingly characteristic of its habit of growing always on *flax*, and is indeed as old as Dodonæus and Gerarde, the author contends that it ought to be retained; and that Weihe's plant (if such an one there be, though he suspects some mistake,) should be named anew, or its character be revised. Mr. Bowman then described the peculiarities in structure of this singular parasite. When it has fixed itself upon the flax, the root and lower part of the stem shrivel up and die away, and a group of little warts or tubercles is produced from the inner surface of the spire between each head, which strike into the flax and extract its juices. This economy places each head nearly in the situation of an independent plant; so that, if the stem were separated at intervals, each detached portion would continue to flower and to ripen its seed. This view occurred to him, on observing that the stem gradually thickened upwards as it approached each head, and was again reduced to half its diameter immediately above it; each head being thus dependent on its own subordinate system of exhausting suckers. Another beautiful compensation for the loss of the root, and supporting the view just advanced, is found in the succulent nature of the flowers, which are as fleshy as the leaves of the mesembryanthemum tribe, and contain reservoirs of nutriment to insure the ripening of the seed, and supply the deficiency consequent on the desiccation of the flax. The author adverted to the total absence of green colour in the dodder and other parasites, which is generally considered to be owing to their not *directly* elaborating their juices from the soil. But the misseltoe is green, though truly parasitical. Others suppose the want of colour to arise from their growing in the shade, or being destitute of leaves; but the dodder, though leafless, grows in the full sunshine; and lathræa has real leaves, though they are buried in the soil, amply furnished with stomata, which line the inner surfaces of cylindrical cells, and are most wonderfully adapted to their anomalous situation. In fact, they are true leaves turned inside out. The real explanation of the absence of green in plants arises, in all cases, from the want of stomata or pores in the cuticle or outer skin; for these pores are the lungs, and through them alone the atmosphere can be admitted, and chemically decomposed, by the action of light; some of its ingredients ministering to the support of the plant, and others entering into new combinations to produce that beautiful variety of verdure, which is the usual summer livery of the vegetable world.

A Paper was then read 'On the Cultivation of the Cotton of Commerce,' by Major-Gen. Briggs. The objects proposed in this paper

are---First, to excite inquiry on the various species of cotton plant that produce the cotton of commerce. Secondly, to ascertain the nature of soils adapted to each. Thirdly, to prove the practicability of cultivating the plant in India, for the supply of the British market to any extent. Of the species that produce the various cottons of commerce, we have at present very little accurate knowledge, and this has arisen from the alterations undergone by the plant in the process of cultivation. But there can be no doubt that the plants which produce cotton in America, Asia, and Africa, are of decidedly different species. The plant that produces the Brazil cotton, probably the *Gossypium hirsutum*, grows to the height of from ten to twenty feet, is perennial, and produces cotton with a long and strong staple, and moderately fine and silky. The plant common to the West Indies, said to have been imported from Guiana, is triennial, bearing abundantly a fine silky long staple, and is the *Gossypium barbadense* of botanists. This also is the plant which produces the Sea-island cotton. When this plant was carried from the coast into the interior of Georgia and Carolina, in the United States of America, the seed changed from a black to a green colour, and the staple became shorter, coarser, and more woolly. This plant was afterwards introduced into Egypt, and is the same that produces the Bourbon cotton, cultivated by the French on that island. Mr. Spalding, in a letter alluded to by Mr. G. R. Porter, in his work on tropical productions, records several varieties, attention to which is of the greatest importance to the cultivation, since they vary in the character of their staple, in the shape and size of their pods, in the hue of the cotton, and in the duration of the plants. The common indigenous plant of India is the *Gossypium herbaceum* of botanists, and differs in appearance from the cottons of the Western world; besides which there is the *Gossypium religiosum*, producing the brown cotton extensively grown in China. It is of the former plant I would desire to speak more especially. It is usually cultivated as an annual, but has been successfully treated and grown as a perennial by the process of pruning down when the cotton is gathered. The produce of this plant is not inferior in fineness, and is superior in point of richness of colours, to the best cottons of America. The staple is however short, and by the great neglect hitherto evinced in picking the produce at the proper time, and carelessness in allowing particles of dried leaves, or the calyx of the flower to adhere to the wool, it fetches a lower price, and is considered an inferior article, in the English market, to the New Orleans and Georgian of America, though really superior in quality and durability. There is another kind of cotton produced from a species in Africa which Dr. Royle considers allied to the *Gossypium herbaceum* of India. We now come to speak of the soils in which these plants are cultivated. Several specimens of American soils on which cotton is grown, have been analyzed by Mr. E. Solly, and he finds them generally to consist---first, of a preponderating quantity of sand (silex). Secondly, of alu-

mina or clay. Thirdly, of the oxides of iron and manganese, which give the warping colours to the soil. Fourthly, of very small proportions of carbonate and sulphate of lime. And lastly, of organic matter in two states; a fibro-vegetable and a soluble matter forming from four to eight per cent. Soils of this kind where hardly anything else will grow, are adapted for the cotton plants of America; a fact mentioned by Mr. Porter, and confirmed by Mr. Gray, who was for some years a cultivator of the plant in America. The land on which the indigenous plant of India termed *Gossypium herbaceum* grows, is very different. It is composed chiefly not of sand (silex) but of the results of the decomposition of trap rocks, the *debris* of the mountains that constitute the extensive trap formation of central India. This soil lies upon or borders on the limestone; it contains a large quantity of vegetable matter, abounds in oxide of iron, is retentive of moisture, and forms a rich, tenacious loam approaching to clay. Such is the soil of the indigenous cotton plant of India, and therefore differs from that of America, so that we ought not to be surprised to learn that all attempts at cultivating the American plant in this soil have failed. But there are in India abundant other soils on which the indigenous plant will not thrive. These prevail in Bengal. on the Coromandel Coast, and in fact throughout India. They consist mainly of the detritus resulting from the disintegration of rocks of the primary and secondary formations, such as granite, gneiss, sandstones, with here and there lime, producing a light soil, fertile or otherwise according to the quantity of organic matter it may contain. The indigenous plant will not grow here, but the American plants thrive on it. This has been proved by experimental farms near Bombay, and the Western Coast, in Upper Hindustan, on the Malayan Peninsula, and on the shores of Coromandel, in all of which tracts the American plants are growing at present in much perfection, though not in quantities sufficient to make any impression on the cotton market of this country. India could supply all the cotton Great Britain can ever require, even from her indigenous plants, but for local obstacles. The soil, favourable to the growth of this article, however, is situated in a central region removed from the coast, and the trade consequently labours under the difficulty attendant on a lengthened journey by land. This will not be the case when the cotton is grown on the lighter soils of the coast. Here every facility exists for its exportation, for there is no doubt that an article equally good might be obtained at a much cheaper rate than that now procured from America.

Mr. Felkin stated, that there was no objection to Egyptian cotton on account of its quality, but it could not be bleached. There was also much sand in it; this was why it was not more used; and no cotton, however cheap, would be purchased in the market with these drawbacks.---In answer to an inquiry, Gen. Briggs stated, that the nankeens of commerce were made from a naturally brown cotton, probably the *Gossypium religiosum.* This was a very different plant from the indigen-

ous cotton of India.—Mr. Danson had seen cotton from Peru equal to Sea island, in point of silkiness, length of staple, &c. The specimens of cotton from Burmah, now exhibited, he thought were of a very superior quality. Other products, he thought, might be imported from the East, such as wool.—Gen. Briggs did not know where the wool of the East Indies was brought from. Shawls were embroidered at Delhi, but not manufactured. Many of the products of the East Indies could be imported; but it was a curious fact, that at the present moment, although we had possessed India so long, we absolutely knew nothing about its productions and capabilities. We had sent annually from England thousands of gallons of linseed oil to India, whilst millions of pounds of the seeds of linum were rotting throughout the whole country. There were not less than fifty species of plants, from which we might obtain caoutchouc; and yet we had imported but little from thence.

Section E.—Medical Science.—Wednesday.

Mr. Evans presented to the Section an extraordinary case of Spina bifida. The patient was a boy of twelve years of age, enjoying excellent general health in other respects; he was strong and active, but his head seemed enlarged from chronic hydrocephalus. The tumour occupied the lumbar regions, was semi-transparent, and the size of a child's head.

'Observations on Poisoning by the Vapours of burning Charcoal,' by Dr. Golding Bird.—Dr. Bird stated, that he was induced to examine into the subject experimentally, from the discordant opinions hitherto published on the various questions connected with it in a toxicological point of view. An opinion has been held, that vapours of carbonic acid were more injurious when produced by the combustion of coal and charcoal, than from any other source, on account of the admixture of light carburetted hydrogen gas. This opinion he dissented from, as it was well known that in coal-mines the fire-damp, as this gas was called, was inhaled, with perfect impunity. To ascertain the *modus agendi*, of the gas when inhaled, he made numerous experiments, by immersing animals in different mixtures of it and atmospheric air, as well as in the pure gas. In the latter case, the animals died asphyxiated, as when immersed in water or mercury, the spasm of the glottis preventing any portion of it from being inhaled. If not more than 25 per cent. be present, then respiration will go on, and its true poisonous effects take place. As to the amount of this gas necessary to produce fatal effects, Dr. Bird found that as a general rule, any quantity above $3\frac{1}{2}$ per cent. was capable of producing death. Two opinions prevailed on the nature of these properties: the first was, that the gas acted negatively, as pure nitrogen or hydrogen is known to do, by preventing the due supply of oxygen. To test this opinion, he formed a mixture containing twenty-

one parts of oxygen, and seventy-nine of carbonic acid, and death followed instantly from immersion in it; and the same result followed when the proportion were reversed, although a taper burned brilliantly in the latter combination; showing, that the burning of a light in any suspected situation is not always a safe test of the absence of danger. The second opinion is, that this gas, when respired, exerts a specific poisonous action on the nervous system. This latter, Dr. Bird adopts, from various considerations drawn from his direct experiments, and from the symptoms observed in numerous cases. These are principally those denominated cerebral, such as head-ache, vertigo, suffused eyes, mental horror to an intense degree. Even with these symptoms, respiration may go on freely. Death is frequently preceded by vomiting, which is a marked symptom of cerebral disease. In cases where recovery has taken place, the sequelæ are decidedly of nervous character: they have been, partial paralysis, dumbness, and idiotcy; and this poisonous effect he thought took place independently of absorption, from its immediate effects on the nervous system, to which it was applied. Death has also been induced by its external application to the body, without its being, at the same time, respired. Dr. Bird related some experiments of Dr. A. T. Thomson, in which the pain of inflamed surfaces was instantly removed on their being plunged into carbonic acid. He dwelt on the pathological effects of the gas as exhibited after death, and concluded by pressing the importance of minute post mortem examinations in every case of death from this cause coming under the notice of medical men.

A member stated from his own experience, that in the burning of charcoal a quantity of carbonic oxide is generated in many instances, and this must be taken into account in any accurate examinations of the question.---Prof. Macartney observed, that when the egg which has been for some time in process of incubation is placed in carbonic acid, and the temperature preserved, the developement of the chick ceases; and this he deemed a strong proof of the action of the gas being on the nervous system, as in this case there is no respiration, and the process supplementary to it is not at all interfered with.

Prof. Macartney then read a paper 'On the Rules for finding with exactness the Position of the principal Arteries and Nerves, from their relations to the external forms of the body.'—He first alluded to the fact demonstrated by painters and sculptors, that the proportions which belong to the external figure of the human body are, in general, regulated by the primary relations of duplicates and thirds, and their multiples; and that he had discovered that a similar law of proportion prevailed with respect to the internal parts of the body—more particularly with regard to the trunks of the arteries and nerves, in relation to the limits of external form. They sometimes take a middle line along the limb, as may be observed in the sciatic nerve, but more frequently they occupy lines dividing the external form into thirds, or proceed from the median line of the side of an extremity to the middle of the opposite side; or

they may pass from the middle to the division into thirds, or from a point placed on a line dividing the external form into three equal parts, and then approaching the middle, so as to form, with the fellow, two parts of a triangle. He illustrated this rule by applying it to the entire course of the artery of the upper extremity, and its principal divisions, from the subclavian to the palmar arches, and from the course of the occipital arteries. He remarked, that the common mode of dissecting arteries and dried preparations was calculated to lead into serious errors, in consequence of which he had been in the habit of teaching relative anatomy, by successive removal of the layers placed above them, so as not to disturb their lateral connexions. The position of the three facial nerves, where they emerge from their foramina, illustrate the same rules, being placed on vertical lines, dividing a well-formed face into three equal parts. Prof. Macartney laid down exact rules for finding the exact points of their emergence. He was not aware that any attempts to lay down proportional measurements had been made in England as a guide in operations, though a few rules have been laid down on this subject by Lesfranc and Manec, in France. After forty-one years' experience of those rules, he could relate numerous cases of their great value in operations, and of the unfortunate results of ignorance of such guides, in cases where operations were performed. In conclusion, he showed that the same primary relations of two and three regulate the progressive movements of animals provided with extremities, and determine also their powers of perception and comparison; and that they constitute the foundation of the rhythm of music and of language. These positions he illustrated by reference to the perceptive powers of man as exercised by the different senses, particularly those of sight and hearing.

'On the Cause of the Increase of Small-pox, and of the Origin of Variola-vaccinia,' by Dr. Inglis.—Dr. Inglis stated, that variola was every year upon the increase, the cause of which was, not that vaccination was inefficient, or that the virus had degenerated, but that, from a long immunity from small-pox, the public had ceased to think vaccination necessary; and he suggested that government should be petitioned by the Medical Section of the British Association to enforce (as is done aboard), not only the vaccination of every child born in the kingdom, but the re-vaccination of every man in the British Service. He next adduced proofs from the cow-pox Institution of Dublin, from foreign reports, and from the innumerable cases of successful re-vaccination, that the vaccine virus had not degenerated, but that the human system did undergo a change during some unknown number of years. In Ripon, during the year 1837, variola prevailed extensively as an epidemic, and Dr. Inglis observed at that time innumerable cases of varicella; those affected with chicken-pox, were principally children upon whom vaccination had not recently been performed, and those who had chicken-pox, without vaccination, seldom contracted small-pox. The two diseases

appeared to Dr. Inglis to arise from one cause. Many cases, to prove convertibility of the one disease in the other, were adduced. Dr. Inglis having full faith in the efficacy of vaccination and of re-vaccination, after first inserting the vaccine lymph, inserted into his arm in several places, the virus from variolous patients in different stages of the disease, and in one instance, from a patient who was dying from the disease, but in none of them did he succeed in inducing an eruption: the inflammation and pruritus was considerable for a day or two, but then gradually subsided. That the vaccine virus, therefore, decreases in its preventive influence is a supposition at least difficult of proof, for, from the beginning, this prophylactic power was imperfect in different degrees, and even an attack of small-pox itself, is no certain security against a second or even a third attack. The next point in the paper was to show that the two visitations of small-pox and vaccination could and did go on in the system at one and the same time, distinct cases of which were brought forward. Now, since two dissimilar contagious irritations cannot run their course together without the one impeding the other for a time, Dr. Inglis was led to suppose that variola and variola-vaccinia had the same common origin, or rather that vaccinia sprung from variola. The paper concluded by the following brief summary:—1st, That small-pox is decidedly on the increase, and that during each successive epidemic there is an increase of variolous patients from amongst those who were vaccinated in infancy. 2nd, That the vaccine virus is as effectual now as ever it was, but that re-vaccination is necessary after a period of years, is yet unknown. 3rd, That the same cause which produces small-pox during a variolous epidemic in the unvaccinated, may and does give rise to chicken-pox in the vaccinated. And 4th, That there is every reason to believe that cow-pox had its origin in variola.

'On the new Vaccine Virus of 1838,' by Mr. J. B. Estlin.—The paper stated that the author had procured some fresh vaccine lymph from the cow in August, 1838, and that in consequence of much dissatisfaction among medical men with the matter previously supplied by the National Vaccine Establishment, numerous applications were made to him for the new lymph, and that it soon became extensively employed. The object of the present communication was to show, that the powers of the new virus diminished in intensity as successive vaccinations increased its distance from the cow. The author had watched it through forty-eight subjects in succession, and for nearly twelvemonths. During the first three or four months, rather severe local and constitutional effects followed. During the latter months, however, of the year of trial, the activity of the matter had greatly diminished; while the vesicle at the present moment produced by it retains all the characteristics of perfect cow-pox, as described by Jenner. The author also referred to some experiments lately made by Mr. Ceely, of Aylesbury, in which cows were inoculated with the matter of *small-pox*, the result of which was, the appearance of the regular *vaccine* vesicle upon the inoculated part of the animal. From

this vesicle, lymph taken and introduced into the human subject, produced the genuine cow-pox.

Dr. Baron informed the Section that he was about to publish a Report on the subject of variola, and that therefore he would not enter fully into the question, but he wished to state the principal arguments for the identity of variola, and what Jenner denominated variola-vaccinia, or cow-pox: the general conclusions he arrived at were as follows:---1st, That cattle in many ages and different countries have been affected with small-pox. 2nd, That those invasions have been simultaneous with the occurrence of the disease in man. 3rd, That it appeared in England, in the year 1745, again in 1770, and continued until 1780. 4th, That the casual transmissions of this disease, preventing the accession of small-pox in man, induced Jenner to propagate the affection from one human being to another. 5th, That when severe among animals, severe also in the human subject. 6th, That as it has been propagated from the cow to man, it has also been transmitted from the human subject to the cow, by inoculation. 7th, That the disease becomes milder when transmitted to the cow, still preserving *its protecting* influence.

Sir James Murray again adverted to a subject brought forward by him at the meeting at Liverpool (see *Athen.* No. 517), the urinary secretions in the circulating fluids.

Thursday.

'On Alkaline Indigestion,' by R. D. Thomson, M. D.---The author stated that he had brought this subject before the British Association at Bristol, but that since that period he had not only from ample experience confirmed the results of his former inquiries, but had elicited several other conclusions of importance. In the healthy state, there is no doubt that during a portion at least of the process of digestion the contents of the stomach are in an acid state. Some had concluded that this acidity proceeded from the presence of muriatic acid, upon what grounds Dr. Thomson would discuss in the Chemical Section (see *ante*, p. 675); others that it proceeded from acetic or lactic acid. 1. Whatever this acid may be, there is no doubt that when it accumulates to a certain extent, the stomach can no longer sustain it, and disease ensues in the form of heartburn, acid eructations, &c. 2. Where the contents of the stomach assume any condition offensive to that organ, either from too much acid or from too small a proportion, the stomach, in many cases ejects a clear fluid, which Dr. Thomson has found to be accompanied by different symptoms, according to the chemical re-action of the fluid: thus in heartburn an acid fluid is ejected, but without any cessation of pain in the stomach; while, on the contrary, if a neutral fluid be ejected, according to the experience of the author, the pain is alleviated on the instant that the fluid is got rid of. This is a more rare case of indigestion, but the author has met with it several times. It may be termed *Neutral Indigestion.* 3. The third form of indigestion which Dr. Thomson has met with, is the alkaline state of the contents of the stomach.

He terms it *Alkaline Indigestion.* The peculiar features of this disease are a violent pain in the region of the stomach, accompanied sometimes with a feeling of fainting, head-ache, and more rarely an inclination to vomit. Suddenly a sensation of spasm comes on, as if some contraction were taking place, and the patient speedily finds his mouth full of water, which he is obliged to empty. This operation he has no sooner performed, than he requires to repeat it, and at last a continuous stream flows from his mouth, which endures for some time, when it ceases, and along with it the pain of the stomach. This, together with the chemical re-action of the fluid ejected, appears to distinguish in a very complete manner, alkaline and neutral indigestion from the acid state, all of which have been confounded by former writers. The distinction is the more important, because these different forms require, in some measure, opposite modes of treatment. With regard to the cause of the alkaline re-action, Dr. Thomson stated that after evaporating the fluid emitted from the stomach, and igniting the residue, he had obtained, by crystallization, fine crystals of carbonate of soda. The presence of these, however, he ascribed often to the decomposition of common salt by the process, or to the previous existence of lactate of soda in the fluid. He was more inclined to attribute it to the former source, because the quantity of crystals was so very considerable. Dr. Thomson stated that the ejection of these fluids from the stomach was much more common than was usually imagined, as out of forty or fifty patients admitted daily at the Blenheim Street Dispensary, in London, he generally found one or two affected with such symptoms. For some years past he had made it a rule always to examine these fluids, and the results of his experiments were embodied in his present communication. He observed that these complaints were frequently symptomatic of diseases placed in other organs, as the uterus, liver, &c. But the secondary disease was often the more disagreeable, and therefore required to be as carefully treated as the original one.

Mr. Hodgson read a paper, 'On the Red Appearance on the Internal Coat of Arteries,' which, he stated, did not depend on inflammation in every instance, and from which it should be carefully distinguished; it might occur extensively, or in small patches, or in different parts of the same subject, presenting different shades of colour. It was found in subjects of all ages, in healthy as well as morbid coats, in the lining membrane of the heart, and of the veins, but less frequently in the latter. It may be found when blood is present in those cavities after death, or where they are completely empty. Mr. Hodgson related the experiments of Laennec and Andral, which proved that this red appearance might be communicated after death by immersing the vessels in blood. As to the efficient cause, he stated, that it might proceed from imbibition, in the same manner as we find the neighbouring membranes stained with bile from the gall-bladder and its ducts; the first changes towards decomposition and putrefaction might allow of it more readily.

Some writers look on it in every instance as the result of inflammation ; slight modifications of vitality may permit its occurrence during life, as we find it, where chronic inflammation has existed, giving rise to deposits of an atheromatous matter. When dependent on inflammation it will be found affecting the inner coat only, but when on other causes it will often pervade the elastic or middle coat as well as the serous. Finally, he stated that it might be found depending on the co-existence of those causes which were capable of producing it singly.

Mr. Hodgson repeated the statements which he made after the reading of Dr. Macartney's paper, on Tuesday ; that, although nature does sometimes use other means for suppressing hæmorrhage, the most frequent mode was a vital constriction and contraction of the coats of the artery, and that this constriction and narrowing of the arterial tube may be produced by exposure and by pressure. That this is the mode adopted to prevent the hæmorrhage in cases of Gangrene, when separation is effected. In support of these views, he presented to the Section some preparations and drawings, particularly illustrating the various conditions in which arteries are found, after successful operations for aneurism: true anuerism, he pointed out as depending on a weakening and degeneration of the middle coat of the artery.

Dr. Macartney thought that it was of importance to discriminate between the red appearances described by Mr. Hodgson and inflammation ; they had a painted appearance, were devoid of tumefaction, and were most perfectly distinguished by being insusceptible of injection. There was, he stated, much analogy in the red patches observed on the pharynx and œsophagus in cases of hydrophobia ; he remarked that these appearances might not depend on the putrefactive process, but be caused more by changes in the blood itself than in the solids. Dr. Macartney dwelt on the important part played by the effusion of coagulable lymph in the closure of arteries, independent of and even previous to inflammation.

Mr. C. T. Coathupe detailed the results of a series of experiments on the Respiration of Deteriorated Atmospheres, which he instituted to determine whether the injurious effects which have followed the respiration of charcoal vapours had depended on carbonic acid, as was generally thought, or on the specific agency of some other volatile product. The volatile products of the combination of charcoal he stated to be as follows :—

Carbonate of Ammonia,
Hydrochlorate of Ammonia,
Sulphate of Ammonia,
Volatile Empyreumatic Oil,
Carbonic Acid Gas,
Carbonic Oxide,
Oxygen,
Nitrogen,
Aqueous Vapour.

From a number of experiments on the elimination of carbonic acid during respiration, he arrived at the following results :—that 266.66 cubic feet of atmospheric air pass through the lungs of an adult in twenty-four hours, of which 10.666 are converted into carbonic acid, yielding 5.45 ounces of carbon, or 124.628 pounds annually, which will give a total of 147.070 tons of carbon as the annual product of the inhabitants of Great Britain and Ireland! The average amount of carbonic acid found in atmospheric air in which animals had expired, was found to be, for warm-blooded animals, 12.75 per cent., for the cold-blooded animals, 13.116 per cent. When the animals were removed, on becoming comatose, the average amount of carbonic acid was found to be 10.42 per cent. On confining a taper until its extinction, the quantity of carbonic acid found was 3.046 per cent. From hence it would appear, that an atmosphere that has ceased to support combustion can support animal life for some time, which Mr. Coathupe proved by direct experiment.

Dr. Costello presented a report of ten cases of Calculus treated by Lithotrity. The patients were of ages between fifty-three and seventy-six, the stones varying in size from that of a pigeon's egg to that of a hen's egg. The lithotrite was successively applied at sittings of from thirty to fifty seconds. Dr. Costello strongly insisted on the necessity of this point, especially at the commencement of the treatment, as the constitution is thus saved from the shock and re-action which follow protracted operation. One of the cases was remarkable: the collected fragments of the removed calculus were shown to the Section; they filled a bottle capable of containing at least four fluid ounces. The patient had suffered upwards of ten years; during the treatment he superintended the farming of his estate as usual, without any inconvenience; the entire of the ten cases were cured, bearing high testimony to the value of this improvement in operative surgery. In connexion with these operations, Dr. Costello related an incident which, to use his own words, "exemplified the progress of surgery and steam travelling,"—he operated on three patients residing in three different counties, and travelled over a space of upwards of 200 miles in eighteen hours.

Mr. Nasmyth read a paper 'On the Microscopic Structure of the Teeth,' in which he treated also of the covering of the enamel and of the organization of the pulp. He first stated that his researches had led him to a conviction contrary to that of Retzius, Purkinje, and Fränkel, for he had found that the enamel *in all cases,* possesses a distinct envelope or coating. On the incisor of the calf, and on several other simple teeth, he had also traced in it the corpuscles of Purkinje, analogous to those found in bone.* With respect to the microscopic

* A full description of this structure will be found in a paper by Mr. Nasmyth, in the forthcoming volume of the Transactions of the Medico-Chirurgical Society, accompanied by drawings.

structure of the teeth, Mr. Nasmyth treated principally of the interfibrous substance, which he said was not "structureless," as has been erroneously stated, but decidedly cellular. The fibres themselves he described as presenting an interrupted or baccated appearance, as if made up of compartments, which differ in size and relative position in various series of animals. He detailed their peculiarities in the human subject, in some species of the monkey tribe, and in the oran-outan. After the earthy matter of teeth has been removed by acid, the animal residue, he stated, consists of solid fibres, and if the decomposition be allowed to continue, these fibres present a peculiar baccated appearance. The general appearance of the fibres treated by acid is similar to that of the fibres of cellular tissue generally, and the diameter of each corresponds exactly to the calibre of the dental tube, as described by Retzius, and which, according to that writer is pervious, although, at the same time, he says, that it is always more or less filled with contents of an earthy nature. With regard to the internal structure of the pulp, Mr. Nasmyth stated that the number of minute cells presenting themselves in its interior, in a vosicular form, is very remarkable. They vary in size from the ten-thousandth to one-eighth of an inch in diameter, and are evidently disposed in layers. The parenchyma of macerated pulp is found to be traversed by vessels, and to be interspersed with granules. The arrangement of these cells or vessels, Mr. Nasmyth thinks, may account for the shrinking or nearly total disappearance of the pulp which he has frequently observed: their use in the economy of the part he has not yet ascertained. They are evidently filled either with air or fluid. He finds that they exist on the formative surface of the pulp. Mr. Nasmyth next proceeded to the nature of the process by which the ivory is developed. The formative surface of the pulp, which is in apposition to the ivory, and by which the latter is produced, he described as presenting a general cellular arrangement, which he denominated reticular, resembling a series of skeletons of a desiccated leaf. This reticularity is found to have peculiar diversities in different classes of animals. Mr. Nasmyth has found that a similar appearance is presented by the capsule and by the capsular investment of the enamel. The leaves or compartments of the reticulation are surrounded by a well-defined scolloped border, from which occasionally processes are observed to arise at regular intervals. With respect to the formation of the ivory, Mr. Nasmyth stated that he was not prepared with a satisfactory theory, and would only submit a few observations based on his own researches. On the surface of the pulp, he said, are found innumerable detached cells with central points, which latter are at regular intervals corresponding in extent to those existing between the fibres of the tooth. The cellules of the fragments of the ivory which are found scattered on the pulp, resemble exactly in size and appearance the cellules of the latter when in a state of transition. Mr. Nasmyth is of opinion that from the spirally fibrous frame-work of the reticulations are evolved the spi-

ral fibres of the tooth. The diameters of the two sets of fibres exactly agree. The projections on the formative surface of the pulp correspond to the centres of the cells, may be traced to belong to their structure, and are evidently fibres passing upwards from the pulp. Mr. Nasmyth has also ascertained that the fibres of perfect ivory resolve themselves by decomposition into similar granules. He has not discovered the manner in which the osseous matter is deposited in the cells of the interfibrous substance, but he has observed that these cells are subdivided into minute cellules, for they present the appearance of being filled with smaller cells in certain progressive stages of development. But in whatever aspect, said he, we view the formative organs of the tooth and the dental tissues, themselves, and whether we examine the latter during the process of their development or after their formation has been completed, we are everywhere met by appearances which denote a cellular or reticular arrangement. Mr. Nasmyth concluded his paper by a notice of Schwann's work on the cellular character of primary tissues, dwelling on his views of the cellular organization of the pulp, from which his own were essentially different.

Saturday.

Dr. Ludwig Guterbock exhibited a number of instruments made from ivory, softened by the removal of the earthy matter by the action of dilute acid. In a brief memoir on their origin, he showed, that the first idea of the preparation was not due either to the German or Parisian individuals who had claimed the honour, as it was contained in an English work, published some time ago, under the title of 'Useful Arts and Inventions.'

Mr. Nasmyth read a paper 'On the Structure of the Epithelium,' which he described as being composed of cells. He first alluded to the views of Leewenhoek on the subject, contained in letters to the Royal Society, written in 1674, and 1684-5, and according to which, this tissue is composed of scales. The researches of subsequent inquirers tend to prove that scales or cells of various forms exist on the surface of all mucous and serous membranes, on the inner membrane of the vascular system, &c. Mr. Nasmyth described the epithelium as a layer of substance destitute of vessels, covering the vascular surface of mucous membranes. The scales, as they were first termed by Leewenhoek, of which it is composed are flat bodies, with a thick portion or nucleus in their centre, and with very thin and transparent margins, which are sometimes curved; their surface often presents numerous transparent points, with very fine lines. The nucleus of the scale generally contains a small body, which has been called the nucleus-corpuscle. If the secretion be removed from an irritated mucous membrane, these bodies are found to assume the appearance of cells, but generally at the surface they resemble scales, from having increased in size, and undergone compression. In the fœtus, the well-defined scales of the epidermis are

not unfrequently seen externally; the *rete malpighii* consists of newly-formed cells; and between the two may be observed other cells, in a state of progressive development. In the epithelium generally, a nucleus is first formed, and then a cell is formed around it. These cells are connected by a gelatinous substance, interspersed with minute granular bodies, which displays considerable elasticity, and which sometimes presents a fibrous appearance. The granules can be caused to disappear by compression. In certain parts of the epithelium of the calf, distinct fibres are observed to pass over the surface of the scales, and to connect them together, thus forming a very delicate net-work. On the surface of the body and of the mucous membranes of a man and animals generally, the superficial scales are thrown off by pressure from the cells beneath; but in some cases, as with frogs and efts, the epithelium scales are removed in a continuous layer; and Mr. Nasmyth is disposed to believe that it is the covering which, according to naturalists, is swallowed by the animal after having been shed. The cuticle and epithelium then are evidently organized bodies. It would appear that they are formed from a fluid secretion, and that their various stages of development are as follows: 1st, the formation of nuclei and their corpuscles;---2nd, that of cells;---3rd, the growth of the latter effected by vital imbibition;---4th, their compression and gradual conversion into minute lamellæ, or scales. The cells seem to have within themselves a power of growth, and it remains for pathologists to determine what share the derangement of this function has in the production of cutaneous diseases. Under certain modifications, the epithelium certainly presents vital phenomena, among which may be mentioned the ciliary motions. Mr. Nasmyth concluded his paper by an especial description of the portion of the epithelium lining the cavity of the mouth. In the fœtal subject, previous to the extrusion of the teeth, it forms on the alveolar arch a dense projecting layer, distinguishable from the surrounding membrane by its whiteness, and by superficial and waving ridges and sulci. The younger the subject, the greater is its thickness. It is made up of a mass of scales, lying one above the other, and thus presents no resemblance to cartilage though it has been generally classed as such. In the interior of its structure, where it corresponds to the molar teeth, small vesicles may be frequently observed, varying in size from one-fourth to one-eighth of a line in diameter. On microscopic examination, the particles of these are found to consist of attenuated scales, and their cavity to contain a fluid abounding in minute granules and cells. They are probably the "glands" described by Serres as intended for the secretion of the tartar. Larger vesicles are also found implanted in the vascular mucous membrane, composed of a very delicate tissue, and containing a transparent fluid, which coagulates on the application of heat or acid. In this fluid float numerous globules and scales, similar to those of the epithelium generally. The internal, or attached surface of the alveolar epithelium presents numerous fringed

processes, which sink into the substance of the subjacent mucous membrane. These are found to be composed of elongated scales. By immersion in water or diluted spirits of wine, these fringes are much enlarged, and their size, indeed, exceeds that of the dense epithelium itself.

Mr. Hodgson made some remarks on organization without any perceptible vascular connexions, and referred to the ovum at an early period, and the crystalline lens, as examples.---Dr. Macartney brought forward the circumstances under which loose cartilages existed in the knee joint as instances of the same phenomena, which he said increased and decreased, and changed their structure, existing at first as coagulable lymph, and afterwards as cartilage and bone, without any vascular connexions.---Prof. Partridge adduced as instances the loose bodies in the sheaths of tendons, which he knew to enlarge, though they were previously completely detached.

Nouveaux Memoires de la Société Imperiale des Naturalistes de Moscow, Tom. iv. (with 13 plates, and forming the 10th vol. of the Collection). Moscow, 1835, 4to.

In noticing for the first time the Memoirs of a Society which is likely to be little known to many of our readers, we may mention that the Imperial Society of Naturalists at Moscow has existed for many years, and has published numerous volumes of valuable transactions. Its primary object is to investigate the natural history of Russia, and for this purpose a museum is formed, and almost every year individuals are sent, at the expense of the Society, to examine the most remote and least known portions of the empire. The whole expenses of the Society are defrayed by the Emperor, who presents it with an annual donation of 10,000 R. ass. In addition to this each member contributes yearly 30 R. which forms a sum in reserve. Each member on admission must present to the Society a memoir, or a work known to scientific men. The meetings are held monthly. The memoirs are allowed to be written in Latin, German, French, English, Italian, or Russian.

The volume of Transactions referred to above is almost exclusively devoted to Entomology. The first paper, which occupies 113 pages of the volume, is entitled, "Additamenta Entomologica ad Faunam Russicam," and contains the descriptions of no fewer than 283 *new* species of Coleoptera. These were collected in remote provinces of the empire by Szovitz, an individual employed principally to examine the botany; but who devoted his leisure hours to what has been called its sister science. This person having been carried off by fever while prosecuting his researches, M. Faldermann was employed to render his entomological discoveries available to the public. While engaged in this undertaking, another collector, named Ménétriés, returned from the

Asiatic provinces with numerous acquisitions, and it was deemed advisable that the discoveries of both should appear together. The result is the highly important addition to the number of known species mentioned above. Most of them have been referred to already existing genera, but in four instances, M. Faldermann found it necessary to establish new genera. These he has named *Platynomerus*, *Microderes*, *Tanyproctus*, and *Pachymerus*. The former of these is nearly allied to Pristonychus, the second to Platymetopodis of De Jean; the third contains two lamellicorn insects, and its station is indicated between Melolontha and Scarabaeus; the fourth likewise belongs to the lamellicorn section, and has considerable affinity to Amphicoma. Several of the species are of considerable size and brilliant colours. Such especially is the Carabus Humboldtii, which is equal in size to any of our native species, and has the elytra finely glossed with copperyred. Thirteen new Cetonias are described and figured, and many of them partake of the lustre and rich colouring which distinguish that beautiful tribe. The brachelytrous species amount to 16. Among the malcodermata, a new species of Lampyris (*L. orientalis* pl. 6. fig 6, 7), is introduced, so closely resembling our native glow-worm that it might readily be taken for a variety. The eastern insect, however, is distinguishable by being broader, by having the elytra darker and more dilated behind, while there are three distinct ridges along the surface of each. Cicindela has received an accession of five species, Cychrus 1, Carabus 12, Harpalus 11, Cantharis 11, Silpha 6, Onthopagus 12. This paper does not advance beyond the section Heteromera, but the remaining tribes have to appear in a subsequent faciculus. The plates, it may be added, are in general well executed, but in no instance are dissections given. Magnified representations of the oral organs when new genera are proposed, as in this case, should be regarded as quite indispensable.------II.---*Description de quelques Coleopteres recueillis dans un voyage au Caucase et dans les provinces transcaucasiennes Russes en,* 1834 et 1835. Par T. Victor. This paper is chiefly occupied with descriptions of those minute and singularly formed insects composing the family *Pselaphidæ*. Many new localities are cited for species previously known, and a considerable number described and figured, which are considered new. We are likewise made acquainted with a few minute Coleoptera belonging to other families, which do not appear to have been previously noticed by entomologists------III.---*Lettre sur le genre Xeranthemum.* Par F. E. L. Fischer, et C. A. Meyer. The object of this paper is to elucidate the structure and history of various species of this interesting tribe of plants. Some new kinds are noticed, and useful observations advanced on the synonomy of those formerly described. It is accompanied with lithographic plates, illustrating the structure of the flowers and pappus.

Bulletin de la Société des Imperial Naturàlistes de Moscow. Tom. ix. Accompagnè de ix. Planches. Moscow, 1836. 8vo.

Art. 1. The first 115 pages of this volume, of which we need mention only the principal articles, are occupied with a paper by Dr. Besser, entitled "Supplementum ad Synopsin Absynthiorum, tentamen de Abrotanis, dissertationem de Seriphidiis atque de Dranunculis," designed to convey additional information on these subjects, which had previously been treated more at length by the same author.——2. Ueber die erste ursache der unebenheit der festen erdoberflæche.——3. Helices proprie dictæ hucusque in limitibus Imperii Russici observatæ, a Joanne Krynicki. This individual appears to have examined the terrestrial mollusca of Russia with great care, and this communication forms a sequel to others already published by him on the same subject. No fewer than forty-one species are described in this paper very minutely, with their synonyms given at length, and several new species are introduced. In the genus *Helicogena* (Fer.) it is interesting to remark the occurrence of a species well known in more southern regious viz, *H. pomatia*, which has been found in the wooded and shady districts of Volhynia and Poltava, but it must be accounted very rare. Similar observations apply to *H. nemoralis*, which is likewise classed among the rarer kinds. *H. hortensis* and *H. arbustorum*, well known species in this country, have special localities assigned to them, a proof that they are by no means generally distributed; the former has been formed in Volhynia, the latter in Podolia.——4. Uber Irit und Osmit, zuei neue mineralien; von R. Hermann. Discovery of two new minerals, named Iridium and Osmium, among the sandy residuum left after the extraction of platina.——5. Libellululinarum species novæ, quas inter Wolgam fluvium et montes Uralenses observavit, Dr. Edward Eversmann. This notice comprises descriptions of four new species of Libellula, two of Æshna and two of Agrion.——6. Lettre *de M. le* Conseiller d'Etat et chevalier de Gebler, contenant un rapport d'un voyage dans les hautes montagnes Catouniennes jusqu á la frontiere de la Chine, et description des trois nouvelles espécés de coleopteres. The insects described (and figured) are *Heliophilus hypolithus, Clytus Altiacus* and *Chrysomela Kowalewskii*, the latter an elegant species of a rich golden green, with blue ridges on the elytra.——7. Orthoptera duo e montibus catunicis, descripta et icone illustrata, auctore G. Fischer de Waldeim. These insects, which do not seem very dissimilar to other species of *Grillidæ* already described, are named *Œdipa Gebleri* and *Œ. rhodoptera.*——8. Bereicherung zur kafer-kunde des Russischen reiches, Von F. Faldermann. A paper containing descriptions (illustrated by figures) of a considerable number of a new coleopterous insects.——9. Quelques mots sur le Caucase par Jean Kaleniczenkow. The writer was induced to visit the district of the Caucasus by observing that every naturalist who had visited it from

the time of Pallas, had succeeded in discovering new objects of interest. He set out in 1832, and the above paper gives a slight sketch of his proceedings, it being his intention to give a more ample account at some future time. He refers chiefly to the plants observed in his route. In the district of Isioum he describes the mountains as calcareous, containing fossil shells and belemnites, and they produce many plants entirely foreign to the flora of Kharkov. Beyond them appear the plants belonging to the *Steppes* properly so called, viz. *Dictamnus Fraxinella, Statice Gmelini, Glycyrrhiza glandulifera* (Kit.) *Artemisia procera*, &c. At Moskovskaia, in the government of the Caucasus, he observed on the sides of hills inclining to the south, and even on their summits, *Xeranthemum Annettæ, Polygala major, Pimpinella Tragium, Roso pimpinellifolia, Vitis vinifera*, &c. Near Jessuntouk, the ridges of the limestone mountains are covered with *Rhus cotinus, Aconitum Anthera*, &c. The banks of the impetuous river Podkoumok are fringed with *Hippothoe rhamnoides, Tamarix gallica* and *Palisii, Salices*, &c. In a valley surrounded on all sides by mountains, from which the Narzanza takes its rise, and where there are thermal baths resorted to by invalids, the most conspicuous and interesting plants are the following: *Betonica grandiflora, Polygala Sibirica* (Linn.) *Rhinanthus orientalis*, (Linn.), *Primula amoena, Dianthus fragrans, Azalia pontica*, (Linn.), *Trollius Caucasicus*, *&c.*------ Beschreibung einiger neuen in Liefland augefunden insecten, Von B. A. Gimmerthal. Contains descriptions of several new dipterous and neuropterous insects.

Muller's Archiv für Anatomie, Physiologie, &c. Parts III. and IV. 1836.

Ueber de Metamorphosen des Eies der Fische u. s. w. Von M. Rusconi. *On the changes which the Ova of Fishes undergo previous to the exclusion of the Embryo.*---In order to continue his observations on this subject, the author repaired to the lake of Como early in July, being assured by the fishermen that both Tench and Bleak deposit their spawn at that period. On the 10th of that month he procured some eggs from a female tench (Cyprinus tinca, Lin.), and placed them in a glazed earthenware vessel filled with water from the lake. They immediately sunk to the bottom, and two or three drops of milt were expressed from a male fish upon them. The eggs were perfectly transparent, and of a greenish yellow colour, like that of olive oil. The milt was of the colour of milk, but much less fluid. In four hours after the fecundation, some of the eggs seemed to have lost their transparency on one side, and others by degrees assumed the same appearance, so that in twenty-four hours they had all become opaque, and their vitality was considered to be extinct. This the author supposed to have arisen from too large a quantity having been laid one upon another in the vessel, and he ac-

cordingly took a flat shallow dish, the bottom of which was covered with paper, and filled it with lake water. Some more fecundated ova were then placed in it, so that they did not come in contact with one another. In five hours he again remarked that some had become opaque on one side, and in twenty-four hours the same thing had occurred to nearly all. Some few, however, remained transparent, and these he raised gently from the dish, by means of the paper that was under them, and transferred them to glasses of water for farther observation, placing eight or ten in each; in six or seven hours after this operation, he saw by means of a microscope that the embryo had begun to move, and in twenty-four hours (fifty from the moment of fecundation) the young fishes burst through their envelope. The experiment was again repeated in order to ascertain whether the ova of fishes undergo similar changes to those of the Batrachians (vide Analysis of Muller's Archiv at p. 292,) and half an hour after the eggs had been placed in the dish, he lifted out those which remained transparent, and transferred them to glasses as before. It was now his object to destroy the vitality of some of them at each stage of their development, in order to examine the progress that had been made, at leisure, and for this purpose he dropped into the water four or five drops of a mixture of one part of nitric acid and eight parts of water, which had the desired effect. This was applied at intervals of fifteen minutes during ten hours, and the following are the results obtained: Soon after the application of the milt, the ovum of the tench loses its spherical form, and swells out into the form of a pear. At the point where this swelling begins it is surrounded with a cluster of microscopic globules, which before were spread all over its surface. In half an hour the pear-shaped excrescence is divided into four globules; these in a quarter of an hour more are subdivided into eight, and in a similar period into thirty-two, still remaining clustered together on the top of the egg. In another half hour more globules appear, decreasing in size as they increase in numbers, till at length, from their minuteness, the part of the egg to which they are attached becomes almost as smooth as when they were undeveloped. The embryo fish now becomes discernible in the form of a whitish semitransparent speck, which is the rudiment of the vertebral column. The organization of the skin then gradually proceeds, and the embryo increases in length, coiled round the yolk, till the head becomes perceptible. In forty hours from the fecundation, the embryo tench first gave signs of motion, and at most, twelve hours later, it had freed itself from the skin of the egg. The fish is then two lines in length, and the blood has already acquired its natural colour. For some hours after leaving the egg, the young fry appeared stupified; they lie on their sides and are unable to swim, until the swimming bladder is developed, when they immediately assume their proper position and their natural activity. The intestines are not fully developed until seven days after leaving the egg, when they begin to feed voraciously, and exclusively upon animal substances. The fry

of the bleak, on the contrary, will only eat vegetable matter, at least during this early period of their existence. The temperature of the room in which these experiments were carried on, ranged from 72° to 77° Fahrenheit. The ova of the bleak are larger than those of the tench, and are for that reason preferable for the purposes of observation, besides being more easily procured. When they had reached the point at which the globules disappear, their vitality was no longer destroyed by the acid before-mentioned; but they were then placed upon a piece of black cloth, or more frequently on a plate of polished silver in a glass of water, and the changes they underwent examined by means of a single lens. The author afterwards had an opportunity of watching a large shoal of Cyprinus Gobio in the act of spawning; he took up three or four pebbles upon which about a dozen eggs were deposited, and placed them in an earthenware vessel in his room, and paid no farther attention to them. About eight or ten days after, he observed four young fish swimming about with vigour, which were so transparent as not to be easily seen except in dark-coloured vessels, and he appears to have met with none of the difficulties in rearing fish from the ova, which Herr von Bäer states to have so much impeded his observation.

These numbers also contain a paper on the Spermatic Entozoa of vertebrate animals, by Professor Wagner, and one on those of the invertebrata, by Dr Siebold of Danzig. The latter author also has one on the anatomy of the Asterias; and there is likewise the first part of a paper on the effects produced by acetate of lead on the organism of animals (dogs and rabbits), by Dr C. G. Mitscherlich.

On Collections and Museums. By Mr. J. M'Clelland.

We make no apology for extracting the following from the Proceedings of the Asiatic Society; chiefly consisting of the remarks of Dr. Horsfield, the Curator of the Honorable Company's Museum, contained in a letter in which he solicits from India contributions for the collection under his charge, regarding which he observes---

"The Museum itself is not very extensive, but it is nevertheless of much importance in connexion with Indian zoology, as it contains several extensive local collections.

"It consists mainly of the following Faunas, which are more or less perfect :—

"*Firstly.* A collection of upwards of 200 species of birds from Java, and a proportional number of quadrupeds. This was formed by myself, and brought to England in 1819, when it constituted the nucleus of our zoological collection.

"*Secondly.* We have a pretty complete series of Birds collected in Sumatra by Sir Stamford Raffles, and some of his Mammalia.

"*Thirdly.* We have a similar collection made by the late Dr. FINLAYSON in Siam and in the Indian Archipelago.

"*Fourthly.* We have a nearly complete series of Mammalia and Birds collected by Colonel SYKES in the Dekun, of the importance and extent of which you can judge by the respective catalogues contained in the Proceedings of the Zoological Society for 1831 and 1832.

"*Fifthly.* We have a few specimens from China, Nepal, and the Upper Provinces of Bengal, but these are imperfect and fragmentary.

"To these has now been added a series, almost complete, of the Mammalia and Birds collected by yourself in Assam, which have been mounted, and form a valuable addition to the specimens exhibited in our Museum.

"All these separate Faunas are neatly arranged in our natural history department, which consists of a large room well lighted, and provided with excellent cabinets for the preservation of the subjects.

"This Museum I may say is established on a modest scale, and without the pretension to extent or elegance of the national collections (such as the British or Hunterian, or even the Zoological Societies) but our specimens are generally good, being prepared by the best London artists, and my endeavour is to have them correctly labelled.

"Our collection consists mainly of Quadrupeds and Birds; but we have also a small collection of Fishes, Reptiles, and Serpents, which have recently been examined by Dr. CANTOR, who has prepared a list of them, agreeably to which they are arranged.

"It is my intention as soon as possible to prepare a general list of the Mammalia and Birds which are arranged in our Museum for transmission to you, so that you may form an accurate idea of what we have, and be enabled to judge of what we want.

"I have no doubt the nature and importance of natural history is more considered and appreciated now, than it was in former times; and I cherish the hope that the countenance and support of Government will ere long be extended to it in an effectual way; but this I can at present only allude to as a wish or expectation. Meanwhile I may enumerate some of the subjects which would be particularly desirable. We want, for instance, many of the birds of Bengal. All the rarer species, and some of the more common (of these I hope soon to send you a provisional list); we want generally the Birds of Sylhet, the Garrow Hills, Tenasserim, Arracan, Burmah, &c. &c., and duplicates of the new, and of all the rarer species discovered by you in Assam.

"We want a complete series of the Birds of Nepal, also Mammalia; the smaller species would suit our purpose best, as we can more easily accommodate them. But above all, and especially, we want a large, full, and complete collection of all the *Vespertilionidæ*, or *Bats* of India. This is the most important family, as it has never been sought after; and I beg and entreat you to have a large collection made generally throughout all India; and I need not point out to you the localities where these animals are most likely to be met with."

Here Dr. HORSFIELD enters into particulars regarding the genera and species.

"But besides these it is in the branch of *Entomology* that I would at present strongly solicit contributions to the Company's Museum. I am more anxious on this head, as I have succeeded in bringing an extensive collection of Insects from Java in excellent condition, and with the exception of these, and the collection of Colonel SYKES, we have absolutely nothing from Bengal or from India generally."

On this subject Dr. HORSFIELD delicately alludes to the probability of gentlemen connected with missions still holding collections of Insects unappropriated, under the supposition, perhaps, that such objects would be less appreciated than the large animals; on the contrary, Dr. HORSFIELD states that contributions to this department of the Museum would be as likely as any other means to promote the interests of science, and to secure the approval of those who are interested in the collection at the India House.

With regard to Insects. The public collections which remain, I believe, unappropriated, are those made by Dr. WALLICH, Mr. GRIFFITH, and myself, when employed on the Assam deputation, and Dr. HELFER's collection. That which was made by the Assam deputation is still, I believe, at the Botanic Garden, and like Dr. HELFER's collection has not yet been transferred to the Government. With regard to the former, perhaps the Society has no authority to interfere; but as the Society has been authorized to take one series of Dr. HELFER's collection for its own Museum, and to select another for that of the India House, it might be necessary to address Dr. HELFER on the subject, particularly as his collection of birds for the Honorable Court has been packed up for some time in the Museum, and are only detained till the insects which have not yet been submitted to the Society should accompany them.

The large collections of birds and insects made by Captain PEMBERTON during his mission to Boutan, and the officers who accompanied him on that occasion, have been long almost unobserved in the Museum, owing to the late repairs of the house. The greater part of the birds composing that collection were previously in our possession, but such as were new to it were transferred to our cabinets, and the rest enclosed in cases for transmission to the India House. The insects of the same collection which are numerous, and no doubt rich in undescribed forms, are also in course of being dispatched with the birds; a series having been reserved for our own collection. The pains taken during Captain PEMBERTON's Journey, to mark the localities in which the different objects were collected, cannot be too highly applauded, especially as this very important circumstance has been hitherto altogether neglected on such occasions.

Mr. LYELL in a letter addressed to Mr. M'CLELLAND, dated 7th September 1839, states, that he is very anxious for accurate information res-

pecting the geography of living *testacea* and Indian *tertiary* shells, and if furnished with duplicates from the Museum of the Asiatic Society, proposes in return to supply the Society with fossil and recent shells in exchange.

The Society, it is to be regretted, has few fossil shells from Indian beds, and a very imperfect collection of recent species. Indeed the little attention that has been paid to these important subjects in India, seems to have induced collectors to send their contributions elsewhere. Several friends, and others interested in the advancement of science, are most favourably placed on the Malay coast, at various points from Chittagong to Mergui, and we may look, I trust, with confidence for large collections from this quarter in the peculiar department alluded to. I have myself been already indebted for a miscellaneous collection of shells from Dr. Helfer, and slight contributions have been made to our Museum from time to time by different individuals; but I question if we have as yet a tenth part of the species of the Bay, while we are altogether without the corals, polypes, and radiata, so abundant in all the Eastern seas.

Mr. A. P. Phayre, assistant to the commissioner of Arracan, kindly sent me some time since a few interesting specimens of the rocks in the vicinity of Akyab, which are perforated to the height of six feet above the greatest elevation of spring tides, the same as beneath the level of the water, by a species of *Pholas*. Mr. Phayre justly ascribes this to a change of level in the rocks composing this part of the coast, and regards the perforations as identical to those which have been observed in the sandstone at Cherra Ponji. With regard to the Cherra Ponji rocks, I am indebted to Mr. H. Walker for an observation of very great importance when observing the number of *Echinidæ* in my collection from that quarter; he suggested the probability of the elongated moulds contained in what seemed to be perforations, being nothing more than the spines of a *Cidaris*, a species of *Echinus*. On this subject, as well as the *Echinidæ* generally, which I find to be very abundant in the Cherra beds, I hope soon to have a communication to make, being now employed in an examination of the Indian species, particularly those which I have found fossil.

These departments of the animal kingdom are of the more importance to our collections, as we can hardly advance a single step in geology until our cabinets are complete, or nearly so, in recent species.

Mr. Phayre has liberally undertaken to collect for us at Akyab, but we require equally zealous correspondents at Chittagong, Kyuk Phyu, Sandoway, Moulmein, Mergui, and at all the different stations along the coast, before our Museum can be considered in a progressive state.

With regard to fossil species, our collection is equally defective; indeed so long as we are without a complete collection of recent shells, fossil species would be of little interest in our Museum. As proof

of the poverty of our collection, I may remark, that of one striking and numerous family, affording probably some hundred species, most of them found in the Indian seas, yet *two* species only are all we have in our Museum, and these from unknown localities, probably New South Wales.

As animals of this family have been found in a fossil state, in a bed of sand, reposing beneath the common soil of the Sylhet mountains, under circumstances which we are bound to investigate, the fact may induce those who reside along the coasts above alluded to, to contribute their share towards the inquiry, by forwarding specimens of them to our Museum. The dried testa of *Echinida*, called *sea-eggs*, are very abundant, I understand from Captain BROWN, on the shores of Rambree Island, and all the islands from thence to the Straits, while the living animals usually named sea-hedge-hogs, from the number of spines with which they are covered, may be had from rocks in the same vicinity. The bleached shell is seldom perfect, so that the living animals when put fresh into spirits form the more valuable specimens; but from the ease with which the former may be collected and preserved, as well as from their beauty as mere ornaments, they ought to form a portion of every collection, and from the philosophical interest of the subject, they would be a welcome addition to our Museum.

Enough, I trust, has been said to induce residents on the Malay coast, and other situations where similar facilities are afforded, to enable the Society to avail itself of the offer of Mr. LYELL, and at the same time to enlarge, or rather form its own collections of Indian species.

The interest now awakening in Europe regarding the natural history of this country, is calculated to produce a more powerful effect in exciting a spirit of inquiry here, than any arguments that could be urged on the spot. Thus, we have not only a Museum at the India House, now opened for the exhibitions of animals collected in India, but the first philosophers are ready to co-operate with us and aid our inquiries.

Proceedings of the Asiatic Society of Bengal.

For the circumstances that gave rise to the following report, we must beg leave to refer our readers to the Journal of the Asiatic Society, in which the Proceedings of the Meeting of February last are recorded. The peculiarities of the case are simply these,—In May last we were appointed Curator of the Society's Museum on the usual salary of 200 Rupees a month. In July, it having been represented by the Secretary that the expenditure exceeded the receipts of the Society, then to prevent danger to the institution from this cause, we gave up the salary attached to our office, and continued to discharge the duties on

this footing till 26th January last, when it appeared that the Government had sanctioned what could be regarded neither more nor less than the restitution of our salary, at the same time placing funds for the purpose at the disposal of the Society. Conceiving that the stipulations insisted on by the Society would only have the effect of rendering the office of Curator a dead letter, as far as the objects of the Government, and the interests of science are concerned, we declined to comply with them. We give the report as we received it.

STET MONUMENTUM!

To DR. J. M'CLELLAND.

We beg leave to inclose for your perusal the Report of the Committee of Papers of the Asiatic Society regarding the duties of the office of Curator to the Museum.

The Report is based on the resolutions of the last Meeting, as set forth in paragraph No. 2.

We will be obliged by your communicating to us your decision as to accepting or declining the appointment.

17*th February*, 1840. *Officiating Secretaries Asiatic Society.*

That the office of Curator to the Society's Museum be held in future on the following conditions. 1st. Two hours at least to be devoted daily to the duties of the Museum. 2nd. Monthly Reports to be made to the Committee of Papers. 3rd. The objects of Natural History belonging to the Society's collection not to be removed from the Museum. It was further decided that the Committee of Papers should report to the next Meeting on the nature and extent of the duties the Curator is to undertake, with reference to the office as held in other Museums.

The Museum of the Asiatic Society of Bengal may be considered to embrace two very distinct departments. 1st. That of Oriental Antiquities, Literature, Architecture, and Numismatics. 2nd. That of Natural History.

It would be of great importance to secure, were it possible, the services of a Curator conversant with both these divisions, but such a combination of acquirements is so rare, that the Society must trust the arrangement, elucidation, and preservation of the articles appertaining to the first division to the honorary services of the "Oriental" Secretary, the Librarian, and Pundits.

In the department of Natural History, it should be borne in mind that the Curator's great object should be to arrange and extend the Society's collections, so as to make these available for the information of the Student, conducive to the general illustration and advancement of Science, and worthy of the place the Society holds among learned institutions. Viewed in this light, it is of far more importance to the Society,

that their Curator should assiduously apply himself to the collection, naming, and arrangement of all procurable specimens of the animal and mineral kingdoms, than, that he should specially devote himself to the minute elucidation of any sub-division of these subjects. By the elaborate investigation of a group or family, he may doubtless distinguish himself, and gain high individual reputation, but his utility to the Society would be far greater, by his applying himself to the humbler duties we have specified; moreover, it appears to us that these duties are in themselves more than sufficient to occupy the Curator's time, were it even to be entirely devoted to their discharge. Our collection of minerals is an utter chaos, though rich in anonymous specimens, valuable in themselves as illustrations of abstract mineralogy, but devoid of interest in a Geological or Geographical light, owing to the neglect with which they have been treated by some preceding Curators.

It appears to the Committee of Papers that the first object of the Society, in remodelling its Museum, should be to form a *grand* collection of minerals and fossils, illustrative of the *Geology*, *Geography*, and *Palæontology* of our British Indian possessions.

A few of the existing minerals and some superb fossils in our Museum are available for this object, but it is clearly within the scope of the Society's influence to procure within a few months, collections of specimens from every part of India, and in such numbers as would find the Curator in ample employment. While waiting for these additions to our collections, he should proceed to name and label those already in our possession. There is no need for delay for the preparation of Cabinets.* The specimens should be named, labelled, wrapped in paper with a number affixed, and then packed in boxes until the cabinets are ready.

This duty the Committee think should supersede all others for the first few months of the Curator's employment, meanwhile his subordinates would conduct the arrangement of such specimens of the animal kingdom, as might require immediate attention.

Duplicates of all specimens should be preserved for *verification* and *analysis*. Triplicates should be retained where ever practicable, for presentation to other Museums in exchange.

The monthly reports should be a statement of progress in this duty, *and affording* a catalogue of the minerals *adjusted*. The specimens themselves should be exhibited to each Meeting.

All correspondence connected with the Museum should pass through the Secretary's office, in conformity with the practice of all similar institutions. It seems to the Committee of Papers an anomalous and inexpedient practice, to commit the whole management of exchanges and similar transactions to the Curator. The suggestions of that offi-

* Admirably consistent with the Secretary's note, Journal Asiatic Society 1839, page 244, in which he declares it would be quite futile to do any thing in this department till cabinets be first provided.

cer will be always received with due attention and respect by the Committee, but it is manifest, that without their being referred to it, the Committee cannot be responsible for the expenditure which the Curator's measures and correspondence may entail, for the views on which he may act in the management of the Museum, nor for the light in which this department of the Society's labours may be regarded by scientific men and institutions in other countries.*

It seems necessary too to stipulate that all memoirs or papers drawn up by the Curator for publication, as well as plates, models, &c. on subjects he may have investigated in discharge of his duties, should be in the first instance placed at the disposal of the Committee of Papers, also that all proofs of such papers pass through the inspection of the same body. The Committee are led to this suggestion by the circumstance of a *fly-leaf* having been prefixed without their *sanction* or *knowledge* to the last Volume of the Transactions. Although containing nothing from which the Committee would dissent, the precedent is one which they are desirous of avoiding, as it obviously may lead to many objectionable results.

The Committee deem it highly desirable to secure, if possible, Dr. M'Clelland's valuable services *on the terms they have now set forth.* His acquirements in the various departments of Natural History, his zeal for the promotion of Science, and the liberality and disinterestedness he has evinced in his past connexion with the Museum, entitle him to be preferred to most competitors for this appointment. The Committee have endeavoured in this Report however to discuss without bias towards any individual, the stipulations for tenure of office which they deem most conducive to the interests of the Society and of Science, and most likely to receive the approbation of the Government, through whose liberal grant the occasion of this discussion has arisen.

In the event however of Dr. M'Clelland's declining to accept the situation on the terms now proposed, the Committee recommend that candidates be invited to present themselves, that the testimonials of such candidates be examined and reported on by the Committee of Papers, and finally considered at a General Meeting. That the individual selected be appointed for 12 months, and his permanent appointment be made dependent on the ability and industry, evinced during the probationary period.

* This paragraph is only calculated to mislead those who do not think, or who do not know the Society. In the first place the Society is not, and never has been, in the habit of making exchanges of objects from the Museum; in the second place the Curator can enter into no engagements in the name of the Society or the Committee of Papers, so that neither of these bodies can be held responsible for his acts; in the third place, there is no correspondence connected with the office, and never has been; and, lastly, it would be the height of absurdity to suppose that scientific men and scientific institutions would or could for a moment hold any or all the members of the Committee of Papers responsible for the scientific part of the Curator's duties.—Ed.

Should no candidate of sufficient acquirements present himself within three months, the Committee recommend that the president be requested to communicate with the *proper* scientific authorities in Europe, authorizing the appointment and dispatch to India, of a competent individual, bound to serve the Society for a period of five years, and subject to the rules herein expressed.

The Committee would not be disposed to extend to any other individual but Dr. M'Clelland the privilege of devoting but two hours daily to the Museum, and would require four hours at least actual attendance at the Museum, from whatever other candidate might be selected.

(True Copy,)

W. B. O'SHAUGHNESSY,
Offg. Secy. Asiatic Society.

Minute by Dr. J. Grant.

I regret that I cannot concur in the whole of this Report, agreeing with much of the general principle that pervades it. I dissent from its application to our peculiar circumstances. The Report closes with a well merited expression of the desirableness of securing, if possible, the services of a zealous, able, industrious, and disinterested naturalist upon the spot, and yet proposes to fetter him with rules, which I fear might damp his ardour and circumscribe his usefulness, without any commensurate benefit to the institution, or perhaps alienate him altogether from a situation which he is well qualified to adorn.

The Report proposes the consideration of the subject entirely on abstract principles, without reference to individual fitness here, or convenience of availing ourselves of such at once, but sincerely believing as I do that the readiest practicable plan is to avail ourselves of the intellectual means at hand, rather than incur the delay of waiting for remote and uncertain materials, I am averse to the adoption of rules which I fear may deprive us of Dr. M'Clelland's services.

The three suggestions contained in the opening paragraph of the report appear to me objectionable, for the reasons to be stated as I proceed. 1st. I would not tie down Dr. M'Clelland (supposing him ready to undertake the office of Curator) to two hours daily *in* the Museum; though it is not unlikely that at an average Dr. M'Clelland would devote so much time to the duties of the Museum;---yet I conceive that the precise locality of duties bearing on the Museum, is of less importance than their being essentially well produced and looked after, not merely *in* the Museum, but out of it, since Dr. M'Clelland might labour very usefully for the Museum in his own house, without a scrupulous and inconvenient measuring of time within the walls of the Museum, that if left to himself might occasionally extend to more even than two hours. 2nd. Monthly Reports, for some time to come, would almost entirely be confined to mechanical arrangement. Quarterly or half

yearly reports, I conceive, would answer every useful purpose, and give less trouble. Let the Committee of Papers be a Committee of Management, and by frequent visits to the Museum obviate any tendency to inaction on the part of the Curator. 3rdly. The non-removal, under any circumstances, of articles from the Museum, would impose a tantalizing restriction. A Museum, especially in India, is not the most favourable place for making minute observations, or recording results and circumstances. There may be several articles that the Curator would like occasionally to carry home to examine quietly in the privacy of his own study, and I should be sorry to cramp any Curator's convenience, by depriving him of this indulgence. To insist upon it, would be like the rule that holds in some libraries, that books should be looked at only on the premises. That rule may be a very proper one in Europe, but I do not think it at present applicable here. Apply the same rule to Numismatology, and it would be found very prejudicial. Had it been strictly acted upon in that branch, I question whether Dr. Wilson and Mr. James Prinsep, (the latter especially), would have effected such splendid results. Neither would I pay our Curator the bad compliment of implying by such a restriction, that he would not take proper care of specimens. Instead of this, I would permit him to carry away what specimens he required, for a reasonable time, the vacant space being occupied with a card or half sheet of paper, bearing the number and character of the article, and the date at which it was borrowed, with the words "Taken by Curator."

Quite concurring in that part of the Report, which states that the Curator's great object, should be generalization of several subjects, and not special devotion to minute observation of a sub-division, yet as I conceive that the two objects are perfectly reconcilable, I have no doubt that Dr. M'Clelland would pay due attention to both. Neither do I imagine that the claims of speedy and effectual mechanical arrangement would at all suffer in the hands of Dr. M'Clelland, or take up so much time as the proposal to tie down that gentleman's passing two hours daily in the Museum would seem to indicate. In conclusion—as far preferable to the plan of sending in three months to Europe for a Curator, and procuring one who after his arrival in India would very likely become discontented at finding himself tied down for five years upon a salary which may sound imposing in Europe, but would be only a pittance for a man of education in India, and scarcely on a par with the pay of some mechanics, I would prefer closing for a twelvemonth*

* The objection to holding the office except on a permanent and independent footing is, that after accomplishing the first step in bringing the collection into order, the office would then hold out so much stronger inducements to those who are fond of sinecures, that a man who relied merely on fitness, might find himself no longer required. Witness the indifference of the Committee of Papers to the Museum as long as the Society had not the means to pay: but no sooner did the Government come forward with funds, than persons whose names had never before been heard

with Dr. M'Clelland, or any other qualified gentleman in India, to whom such a limited salary might be an object, should the conditions of offering the situation to the former be such as to make him decline it.

CALCUTTA,
15th February, 1840.

We do not blame persons for not being naturalists, but when they assume that character under the garb of a Committee, we must hold them responsible for their acts, particularly when directed against individuals whose pursuits might be supposed to be a protection, or when their opinions are calculated to mislead the taste and judgment of the public. The only inference to be derived from the foregoing report, which was got up no one knows how, is, that we have been neglecting the interests of the Museum for objects of more interest to ourselves—that when we ought to have been sitting in the Museum, we have been investigating "groups and families" at home; and every thing calculated to bear upon the disadvantage of this, is brought forward, while all that should excuse it, is suppressed or misrepresented. It is insinuated even that our paper on "Cyprinidæ" was written when we ought to have been doing something else, forgetting that it was presented to the Society nine months before the Committee had any claim upon our time; while they keep out of sight the fact of above 360 animals having been added to their collection during the few months we held office, a third of which were collected by ourselves in that short period. We have merely to add the following extract from our reply to our late just and liberal *masters*, and gladly leave them in possession of the Asiatic Society.

"As the report professes to have framed the duties of the office to which such new interest is attached on the established usage of other Museums, I must be permitted to point out the error into which the *Rapporteur* seems to have fallen.

"The Museum of the Royal College of Surgeons in London is placed under a Board of Curators, over which the members of the College have no authority. I allude to this Museum as one in which the Government have an interest, and in all other Museums to the support of which the Government contribute, the Curators are equally independent. This Board may not only cut and dissect the specimens in such manner as may be deemed essential, but may send them to lapidaries and others to do the same; and Mr. Clift, as well as Mr.

of in connection with natural history, produced their maiden report. Would any one be justified in reposing confidence where there is so little regard for appearance?—ED.

Owen, may make use of the results the same as if they had been derived from their own private specimens.

"The Museum at the India House is placed entirely, I believe, in the hands of its keeper, who may not only make such use of his descriptions of the objects contained in it as he conceives most likely to promote the ends of science, but exhibit those objects when necessary to the Societies of the Metropolis.

"Can the Committee of Papers reconcile this, with the stipulations they require from their Curator? e. g. 'that all *memoirs* or *papers** drawn up by the Curators for publication, as well as plates, models, &c. on subjects he may have investigated in the discharge of his duties, should in the first instance be placed at the disposal of the Committee of Papers; also, that all proofs of such Papers pass through the inspection of the same body.' The reason assigned for this very modest stipulation is perfectly ludicrous, and shows how unfit the Committee is to legislate in such matters, namely, that of a '*fly*-leaf having been prefixed without their knowledge or sanction to the last volume of Transactions, although containing nothing from which the Committee would dissent, the precedent is one they are desirous of avoiding.'

"The Committee of Papers should surely have been aware that it is the Secretary, and not the Curator, who must be held answerable for irregularities of this kind, and yet the odd remedy they would apply is, that of depriving the Curator of the literary property that every one has a right to enjoy in his own free labours. How that could keep 'fly leaves' out of the Transactions, I am quite at a loss to know.

"As the Committee do not profess to think much of the elaborate investigation of a group or family, we cannot be surprised that they should not be disposed to encourage such a waste of time; and hence the clause preventing the removal of objects of Natural History from the Museum. Why, it was only at the last Meeting of the British Association, that Dr. Buckland announced the intention of Messrs. Hutton and Henslow to continue the fossil flora of Great Britain, and of their requiring 'the *loan* of specimens from the Geological Society, which would be carefully returned after drawings had been made of them.'

"Again, the Committee require that all correspondence connected with the Museum should pass through the Secretary's office, 'in conformity with the practice of all similar institutions.' Here the Com-

* The only literary work a Curator is expected to perform in the execution of his duty, is the preparation of a catalogue, of the collection under his charge. Whether that be a *memoir* or a *paper*, I must leave to the legal learning of those who would draw the distinction. Even with regard to a catalogue, I would advise the Committee to imitate the Council of the Zoological Society of London, and declare "that they do not hold themselves responsible for the nomenclature adopted, and opinions expressed in that publication."

mittee no doubt evince the same intimate knowledge of the practice of other institutions, as in the instances already referred to."

It does not appear to have occurred to the Committee, that the Curator being a naturalist can have little correspondence not connected with the Museum, so that to comply with this rule he should require his friends to address him through the Secretary.

" The Committee say, 'our collection of *minerals* is in utter chaos,' a statement which is not the fact, for they are all arranged; a Committee that would lay down rules for the direction of a Curator, ought to know the difference between minerals and rocks. 'Though rich,' say this Committee 'in *anonymous* specimens, valuable in themselves as illustrations of *abstract* mineralogy, but devoid of interest in a geological or geographical light, owing to the neglect with which they have been treated, &c.' We can easily understand that the Committee may have been ignorant of the names of many minerals in the collection, especially as they do not seem to know the difference between minerals and rocks, but it does not follow that such minerals are '*anonymous*;' in fact, the use of the term as the Committee have applied it, evinces a total want of information on the subject; a mineral is not *anonymous* because it is without a label, any more than a man would be so when without a card in his pocket, with his name written on it. a person acquainted with either minerals or men will always know them whether labelled or not. Yet this is the Committee who are ready to take the management of the Museum into their own hands, and as they say themselves, examine the claims of such candidates as may offer for the Curatorship within a period of three months!

"'It appears,' they say, 'that the first object of the Society in remodelling the Museum, should be to form a grand collection of minerals and fossils, illustrative of the Geology, Geography, and Palæontology of our British Indian possessions.' But we are at a loss to know how *minerals* and *fossils* could illustrate *Geography*, and had always supposed that Palæontology was merely a branch of Geology; but perhaps the Committee intend to remodel the sciences, as well as the Museum. 'A few *existing* minerals;' (could there be any other kind? This is the report of a Committee of Papers of a learned Society, claiming an authority quite unprecedented over the labours of others, it is therefore of importance before their claims be sanctioned, to see how far the scientific character of the Society would be safe in their hands) 'and some superb fossils in our Museum are available for this object,' i. e., for making a grand collection; but as the things in question are already in the Museum, they are not merely '*available*' for the object in view, but constitute so much of the object itself already accomplished.

" The Committee continue, 'While waiting for these additions to our collection, he,' the Curator, 'should proceed to label those already in our possession.' It is within the recollection of the Society that

I stated eight months ago that I could do nothing with the geological collection until cabinets were first provided; these were accordingly sanctioned by the Society, but ordered by the Secretary from a native for less than he could afford to provide them; the consequence is, that they still remain unfinished. This is an instance of the ill effects of leaving the Curator dependent on the Secretary, or any one else, for things on which his own work depends; and as the circumstance is brought forward rather unfairly in the report of the Committee, I must be permitted to say, that had any member of that body required an *easy chair*, we may presume he would have obtained it at once from the best cabinet-maker, cost what it might.

"There is but one name attached to the report which can be at all held responsible, in a scientific point of view, for the sentiments embodied in it, and although Dr. Wallich may fairly be exonerated from any great authority on the subject of Museums, yet his own experience ought to have suggested the difficulty of making monthly reports on subjects connected with natural history, he himself finding a single report too much to accomplish in the five years that have now elapsed since his return from Assam."

Directions for preserving Marine Objects of Natural History.

During the expedition to China, there may be opportunities of adding to the very scanty knowledge at present in possession of the scientific world, regarding the productions of the eastern parts of Asia. A memorandum on the means of making collections of such objects as are most likely to be met with in ships, and along the coasts, may therefore be useful, especially to amateurs, who on such occasions may often be in doubt as to the objects they should choose, since they cannot collect all things that may offer. We are not aware that the marine plants of the eastern seas have ever been examined, the following observations on the method of collecting objects of this nature, may therefore be useful. They are extracted from a very good paper on collecting sea-plants, by Dr. Drummond of Belfast, in the Magazine of Zoology and Botany, 1838.

"The first object to be attended to in preserving marine plants is to have them washed perfectly clean before spreading. There should not be left upon them a particle of sand or other foreign body, unless in some rare instance a parasitic species may be thought worthy of keeping, on account of its rarity, or because it may add an additional beauty to the chief specimen. It is a good practice to wash them before leaving the shore either in the sea, or in a rocky pool, or, as is sometimes more convenient in some localities, in a rivulet discharging itself into the ocean, though, as will be afterwards explained, the last practice proves very destructive to the beauty of some species.

"The foreign bodies to be got rid of are fragments of decayed sea-weeds, sand, gravel, and sometimes portions of the softened surface of sandstone or argillaceous rock on which the specimens may have grown, together with the smaller testacea, and the *Corrallina officinalis, &c.* At Cairnlough Bay I experienced most trouble in this respect from the *Ectocarpi*, which confervæ were so generally diffused, as to be entangled with almost every other species of sea-plant.

"After the greatest pains which we may take to clean our specimens at the shore, there will generally be found much to do before they can be properly committed to paper, since foreign substances will continue attached to them with much pertinacity, even after we may have been satisfied that they are perfectly clean. It is therefore necessary to prepare each specimen by examining it in fresh or sea water in a white dish or plate, so that every thing foreign may be detected and removed.

"The next thing to be attended to is the quality of the paper on which the specimens are to be spread: and here a great error is generally committed, in using it thin and inferior, by which, if the specimen be worth preserving, it has not proper justice done to it. Much of the beauty, indeed, of many species depends on the goodness of the paper, exactly as a print or drawing will appear better or worse, as it is executed on paper of a good or an inferior kind. Some species, too, contract so much in drying as to pucker the edges of the paper, if it be not sufficiently thick, for example *Delesseria laciniata*, and this has a very unsightly appearance. That which I have from experience been led to prefer is a thick music-paper. It closely resembles that used for drawing, and the sheet divides into four leaves, of a most convenient size, each being about an inch and a-half longer and broader than a leaf of this Magazine. These, again, divided into halves answer for small species, and for large specimens we may use the entire folio. We have thus three regular sizes of paper, and this serves to give a uniformity and neatness to a collection not to be obtained by using papers at random, and of casual dimensions.

"Whatever pains we may have taken to clean the recent specimens, we shall often find, when spreading them, that some foreign particles continue attached, and for the removal of these a pair of dissecting forceps, and a camel hair pencil of middle size, will be found very convenient. These, indeed, are almost indispensable, and will be found useful on more occasions than can here be specified. A silver probe, with a blunt and sharp end, is the most convenient instrument for spreading out, and separating branches from each other, but any thing with a rigid point, such as a large needle, or the handle of the camel-hair pencil sharpened, will answer. A large white dinner-dish serves perfectly well for spreading the specimens in, and all that is farther necessary is a quantity of drying papers, and some sheets of blotting-paper, with three or four flat pieces of deal-board. Nothing answers better for drying

than old newspapers, each divided into eight parts, but it is necessary to have a large supply of these.

"The beautiful and common *Plocamium coccineum* is one of the most easily preserved species, and may be taken as an example of the mode of proceeding with most of the others. The steps to be pursued are as follow.—

"1. The specimen is to be perfectly well cleaned.

"2. A dinner-dish to be filled about two-thirds with clean fresh water.

"3. The paper on which the specimens is to be spread, to be immersed in the water in the dish.

"4. The specimen to be then placed on the paper, and spread out by means of the probe and camel-hair pencil.

"5. The paper with the specimen on it to be then slowly withdrawn from the dish, sliding it over its edge.

"6. The paper with the specimen adhering to it, to be held up by one corner for a minute or two, to drain off the water.

"7. To be then laid on paper, or cloth, upon a table, and the superfluous water still remaining to be removed by repeated pressure of blotting-paper upon the specimen, beginning this operation at the edges, and gradually encroaching towards the centre till the whole can be pressed upon without danger of any part adhering to the blotting-paper, which probably would be the case, were the latter applied at once to the whole specimen.

"8. The specimen then to be laid on a couple of drying papers placed on the carpet or a table; two more papers to be laid *over* it, and then the piece of board, on which latter a few books are to be put, to give the necessary pressure.

"9. These papers to be changed every half hour or oftener, till the specimen is sufficiently dry. (A number of specimens with drying papers interposed, may be pressed at once under the same board.)

"Though the above method is in general the best, yet there are various species, and among these the *Plocamium coccineum* itself, which dry perfectly well by simple exposure to the open air without pressure being had recourse to at all; and some can only be preserved in the latter way, being so glutinous that they will adhere as strongly to the drying paper laid over them as to that on which they are spread. Pressure however, is necessary after they have dried, for the purpose of flattening them.*

* An indispensable requisite in the drying of marine or fresh water algæ is a portion of old rag, neither of a quality too fine or too coarse. When the specimen has been spread, as directed, upon the paper on which it is to remain, a piece of rag sufficient to cover it should be laid over, and then it may be interleaved under the boards for pressure. The rag prevents the necessity of so much care in taking up the moisture as Mr. Drummond requires, never adheres to the specimens, but when dry, leaves them, while most of the plants themselves stick firmly to the sheets on which they have been spread.—Eds.

"After these general remarks, I will now offer some observations relating to several genera and species, following the order in which they are arranged in the English Flora.

"I believe all the species belonging to the Fucoideæ are to be dried in the manner of land plants, after having been previously steeped for some time in fresh water to extract their salt and mucilage. *Cystoseira granulata*, which I have repeatedly found on the Larne shore, will adhere imperfectly if spread in water, but it is best treated as a land plant, to be afterwards fixed with mucilage. *Halidrys siliquosa, Fucus vesiculosus*, and *F. nodosus* require very heavy pressure. The air-vesicles of the first may be in part cut longitudinally to show the internal partitions, and of the two last, to diminish their diameter, but this must be done *after* they are dried, for if done in the recent state they contract and become disfigured."

A very important part in the art of preserving marine plants is to prune luxuriant specimens, especially such as without this would appear confused and unsightly, but some care is required to prevent the removal of parts on which the character of the species depend; some shrink by exposure to the air, but packed up under gentle pressure, they retain their form, and even when shrunken or dried badly at first, they may be restored to shape by moisture. When collected dry on the beach some are so rolled that they cannot be unfolded, and in that state are nearly useless; some are so thin as to dry readily, and others if steeped in fresh water give out their colouring matter and become changed in appearance. We should think the thick soft paper manufactured at Serampore would answer admirably for preserving marine plants. With regard to land plants no instructions are required.

The only way of preserving animals is by putting them into spirits. This may be conveniently practised with all the smaller fishes, reptiles, birds and mammals, all insects expect Lepidoptera, most of the molluscs and annulose animals may likewise be preserved in spirits; of the Radiata, the Echinodermata alone are to be preserved in any form, but of these the several kind of star fish and sea eggs are very easily collected and preserved, either in spirits or in a dry state.

The skins of the larger mammalia, birds, and fishes, can only be preserved; all the wild species of every class of animals from China and Japan are objects of scientific interest. The pipe fishes and sea horses (Syngnathus and Hypocampus) and the cuttle fishes of all kinds, especially the Calamary from which the China ink is manufactured are objects of especial interest, as well as the fresh water fishes of China. The extent and nature of the trade in the Manilla red fish, as well as specimens and the method of preserving and taking the fish, would be interesting.

Should room be scarce as well as paper for drying specimens in the ordinary way, the fruits and flowers of plants, with a small portion of the stem and leaves adhering, may be put into spirits.

Animals, such as fish, serpents, insects, squirrels, bats, &c. do not

disagree with plants in spirits, but on the contrary mutually assist the antiseptic property of the latter.

Some little attention is requisite not to collect clumsy specimens, or many of the same sort of thing, as this would encroach upon the means of preserving other objects, and limit the variety and value of the collection.

Geological, of all collections, are of least interest unless connected with notes; each specimen should be characteristic of some prevailing rock, and ought to be rolled in paper, numbered, and notes regarding the formation to which it belongs made on the spot.

Nnmber every thing you collect, but mind not names, except such as are indigenous, which are to be recorded, as well as the uses and properties of things collected.

Objects of Chinese *Fauna* likely to be least known and most interesting, are reptiles of every kind, crustea, fresh water fish, land and fresh water shells, and the smaller mammalia; next to these, fishes and shells of the estuaries; above all, cuttle fish from which the Indian ink is made. The sea horses and pipe fishes, *starfishes and sea eggs* of every kind, leeches, worms, scorpions, centipedes, and *insects of all kinds*, except perhaps butterflies, from the difficulty of preserving them perfect, as well as the chance of their possessing fewer peculiarities than other objects.

Where room may be valuable and carriage difficult, nothing large should be attempted, and of all such useless curiosities the proboscis of the saw fish, polished shells, and mandarins tails should be eschewed; even the tail of Lin himself would not be worth its room in such circumstances.

It is useless to say any thing about birds, because every one will collect them, and perhaps every one will find himself in possession of precisely the same species; as will probably be the case with other things.

A small test box with articles enough in it for the cursory examination of waters, as turmeric and litmus paper, nitrate of borytes, acetate of lead, nitrate of silver, acetate of ammonia, prussiate of potash, a blow pipe with two or three acids, and as many alkalies, might be useful with collectors; we never travelled without it.

J. M.